MEMOIRS

OF

THE NEW YORK BOTANICAL GARDEN

VOLUME 27

DALEAE IMAGINES, An Illustrated Revision of Errazurizia Philippi, Psorothamnus Rydberg, Marina Liebmann, and Dalea Lucanus emend. Barneby, including all species of Leguminosae tribe Amorpheae Borissova ever referred to Dalea

RUPERT C. BARNEBY

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(continued on inside back cover)

DALEAE IMAGINES

The original DALEA, now *D. cliffortiana* Willd.,
drawn from life in 1736 by Georg Dionysius Ehret (1708–70)
in the garden of George Clifford at Hartekamp, near Leiden, Netherlands,
and published in 1738 as Table 22 of Linnaeus's *Hortus Cliffortianus*.

Memoirs of The New York Botanical Garden Volume 27

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of
ERRAZURIZIA Philippi, PSOROTHAMNUS Rydberg,
MARINA Liebmann, and DALEA Lucanus emend. Barneby,
including all species of
LEGUMINOSAE tribe AMORPHEAE Borissova
ever referred to DALEA

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In Memoriam

HARRY DWIGHT DILLON RIPLEY

23.X.1908–17.XII.1973

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FOREWORD

While my interest in the Psoraleoid (and Amorphoid) Leguminosae is of several decades' standing, the aspiration to revise the genus *Dalea* and its relatives took root in my mind only in 1961, as my study of North American *Astragalus*, published as Volume 13 of this series, was coming to fruition. In the beginning I planned a simple revision of *Dalea* as understood by contemporary botanists, but I was early confronted by problems of generic, and then in turn of tribal definitions. Having expanded the field of enquiry to the tribal level, I am able to present here, in the context of a newly characterized tribus Amorpheae, a taxonomic revision of four genera: *Dalea* reshaped, with three smaller genera segregated from it.

The herbarium work leading to this book was carried out primarily at the New York Botanical Garden between 1961 and 1971, in which years I enjoyed the privileges of an honorary curatorship. Words are poor things to express my gratitude for the support and encouragement received from the Garden staff during this period. Special debts are owing to Dr. Bassett Maguire, Director of Botany; to Dr. W. C. Steere and Dr. H. S. Irwin, former and present Presidents; and to the herbarium curators, librarians, and secretarial assistants, in particular to Dr. P. K. Holmgren, who selflessly handled the logistics of extensive loans from herbaria in the United States and abroad. The joyous adventure of field-work, in the western United States (1942–1962) and Mexico (1963–1971) was shared and supported by the late Dwight Ripley, to whom this book, to which he contributed so much, is dedicated. Particular mention must be made of Dr. T. Mosquin and Dr. R. Spellenberg, who with exemplary generosity gave me the benefit of important cytological data, thereby, as it were, lending eyes to the blind.

The foundation of the revision is the great study collection housed at the New York Botanical Garden, supplemented by large loans from the Smithsonian Institution, Field Museum, Gray Herbarium, and University of California. By way of loan or personal visit I have had access to a great mass of supplementary material, including types of almost all validly published names in the group. To the curators and keepers of the herbaria listed (alphabetically, by acronym) below, I hereby tender my cordial thanks for that courteous cooperation which makes of Botany a truly international science.

A	Arnold Arboretum, Cambridge
ARIZ	University of Arizona, Tucson
ASU	Arizona State University, Tempe
BH	L. H. Bailey Hortorium, Cornell University, Ithaca
BM	British Museum (Natural History), London
CAS	California Academy of Sciences, San Francisco
DAO	Vascular Plant Herbarium, Central Experiment Farm, Ottawa
DS	Dudley Herbarium, Stanford University, Stanford
ENCB	Escuela Nacional de Ciencias Biológicas, México
F	Field Museum, Chicago
G	Conservatoire et Jardin Botaniques, Genève
GH	Gray Herbarium of Harvard University, Cambridge
K	The Royal Herbarium, Kew Gardens, Richmond
KRA	Herbarium Universitatis Jagellonicae Cracoviensis, Kraków
M	Botanische Staatssammlung, München
MA	Instituto 'Antonio José Cavanilles', Jardin Botánico, Madrid
MEXU	Instituto de Biología, Universidad Nacional Autónoma, México
MICH	University of Michigan Herbarium, Ann Arbor
NY	The New York Botanical Garden, Bronx
OKLA	Oklahoma State University Herbarium, Stillwater
OXF	Fielding Herbarium, Oxford University, Oxford
P	Muséum National d'Histoire Naturelle, Laboratoire de Phanérogamie, Paris
POM	Herbarium of Pomona College, Claremont
RENNER	=TEX
RM	Rocky Mountain Herbarium, University of Wyoming, Laramie
RSA	Rancho Santa Ana Botanic Garden, Claremont
SD	San Diego Museum of Natural History, San Diego
SMU	Herbarium of Southern Methodist University, Dallas
SRSC	Herbarium of Sul Ross State University, Alpine
UC	Herbarium of the University of California, Berkeley
US	United States National Herbarium, Smithsonian Institution, Washington
W	Naturhistorosches Museum, Wien
WIS	University of Wisconsin Herbarium, Madison
Z	Botanischer Garten der Universitt Zürich, Zürich

INTRODUCTION

The taxonomic study of which the results are presented herewith encompasses that group of Papilionaceous Leguminosae characterized by the presence of specialized oil-cells("glands") in the epidermis of the foliage, simple basifixed hairs, and a small, mostly 1–2-ovulate, indehiscent, nearly always 1-seeded pod, which have at one time or another been referred by botanists to the genus *Dalea*. They correspond with a great part of Leguminosae subordo Papilionaceae tribus Galegeae subtribus Psoraleeae Benth. (in Bentham & Hooker, 1865, p. 436, 443, 491, sequ.), a concept preserved unaltered except in a change of spelling ("Psoraliinae") by Taubert (1894) in his treatment of the legumes for *Pflanzenfamilien* and again by Rydberg (1928), except for a change in rank to tribal level (as "*Psoraleae*") and some adjustments or refinements of the genera, in his survey of North American Fabaceae. The tribe Galegeae, already very large and internally diverse when first put together by Bentham, has since received so great an increment of heterogeneous elements as to become essentially indefinable except in negative, exclusive terms. This is less true of the smaller and more exactly characterized subsidiary groups such as Psoraleeae sens. Bentham, but the phyletic unity even of these has come under suspicion with the passage of time. Thus the attempt by Hutchinson (1964, p. 221–489) to reorganize the whole great order Leguminales into smaller, more homogeneous, presumably more natural and hence more useful units was timely and entirely praiseworthy.

In course of reevaluating Bentham's tribal and subtribal classification of the Leguminosae, Hutchinson (1964, p. 413–420) proposed to split subtribus Psoraleeae Benth. into two independent groups of tribal rank, a purified and diminished Psoraleeae ("*Psoralieae*") Benth. emend. Hutch. and a newly segregated Daleeae ("*Daleae*"). The single differential character believed to separate these two tribes is found in the position of the petals. In Psoraleeae the two inner pairs, corresponding with the wings (alae) and keel (carina) of the conventional papilionaceous corolla, arise like the banner (vexillum) directly from the hypanthium rim; in Daleeae they are "inserted on or adnate to the staminate sheath." I do not propose to discuss at this point alternative interpretations of this ambiguous phrase, borrowed from Rydberg's key (1928, p. 198) to the genera of Galegeae, beyond noting that, as the daleoid petal disjoints in age[1] just like that of *Psoralea* or *Pisum*, it appears to be elevated on an outgrowth of receptacular origin and is not adnate to the androecial column by a part of its claw in the manner of many *Trifolium* or *Tragacantha*. For descriptive purposes I have called such petals *epistemonous*, because they appear to be so.

The criterion of sessile versus epistemonous petals, which is without exception a constant and invaluable *generic* character, has the merit of an absolute, black and white contrast, the petals being daleoid if perched, even ever so little, above the hypanthium rim and psoraleoid if issuing from it. At the tribal level it becomes a liability, as it contrives to separate genera (or parts of them) which are felt instinctively to belong together and have by all students of Fabaceae been treated as such. Without paying exaggerated respect to tradition, it is fair to say that it is not by simple chance, or chance fortified by habit, that several generations of Californian

[1] With rare exceptions, probably representing evolutionary reversions: the keel, but not the wings, of *Dalea neo-mexicana* and some close kindred are marcescent, as are all five petals of *Psorothamnus thompsonae*.

botanists have agreed to admit to *Dalea* that group of desert shrubs segregated by Rydberg as *Psorothamnus* and *Psorodendron*, an alignment accepted by Isely (1958) in his revision of Psoraleeae. Nor did Rydberg (1928) himself, in his summary discussion of the genera of Galegeae, question the close kinship of his segregate groups to the matrix of *Dalea* (or *Parosela*) from which he had excised them. But Hutchinson, emphasizing the one character of sessile petals at the expense of multiple similarities in habit, foliage, glandular ornament, and fruit, retains *Psorothamnus* in Psoraleeae, as though it were more closely related to *Psoralea* than to *Dalea*. This arrangement evokes in the mind of one familiar with these American genera feelings of discomfort, even disappointment, not easily dispelled, suggesting, as it does, that phylogenetic relationship has been sacrificed to taxonomic convenience. Hutchinson's scheme for dismembering Psoraleeae sensu Bentham can be criticized, however, on more factual grounds. He attributes to Psoraleeae the hitherto monotypic genus *Marina* Liebm. (greatly expanded herein), apparently unaware that the inner petals of the generitype are epistemonous and that the one original species was long ago correctly equated by Rydberg (1919, p. 51) with a *Parosela*; he maintains *Psorothamnus* and *Psorodendron* simultaneously as genera of Psoraleeae in good standing and as synonyms of *Dalea* in another tribe; and he makes a distinction, where almost none exists, between *Errazurizia* Phil., placed as a synonym of *Dalea* although in fact characterized by sessile petals, and the supposedly psoraleoid *Psorobatus* Rydb., which has essentially the same flower. It is precisely these ambiguous genera *Errazurizia* (including *Psorobatus*) and *Psorothamnus* (including *Psorodendron* and *Asagraea* Baill.), where the aspect and many morphological characters of Daleeae coincide with sessile petals proper to Psoraleeae sensu Hutch., which reveal a fatal weakness in Hutchinson's tribal definitions.

If the criterion of petal-insertion indeed fails to divide subtribe Psoraleeae sensu Benth. without distorting our concepts of intergeneric affinity, the question arises as to whether the group may not be, after all, monophyletic and taxonomically indivisible. Perhaps no universally acceptable answer exists in our present stage of knowledge. The Psoraleeae can, however, be divided neatly into approximately equal halves along another, seemingly more natural line of cleavage than any hitherto recognized, a line based on ontogeny of the branching patterns and the position of the inflorescences in relation to their axis of origin. It seems possible, indeed likely (because yielding happier returns), that the branching patterns are more basic and primitive features than the evolution of epistemonous petals, evaluated by Hutchinson as hallmark of the tribe. Sorted by a different set of criteria, the genera of Bentham's Psoraleeae dissolve into two sharply differentiated groups for which the oldest tribal epithets appear to be Psoraleeae Benth., sens. restr. and Amorpheae Boriss., the latter embracing the genus *Dalea* and therefore replacing the shortly posterior Daleeae Hutch.

In genus *Psoralea*, whether limited to its Old World representatives (as envisaged by Hutchinson) or expanded to include the New World segregates *Pediomelum* Rydb., *Orbexilum* Raf., *Psoralidium* Rydb., *Hoita* Rydb., etc., every spike or raceme (the latter sometimes reduced to a fascicle or a single flower) arises laterally from a leaf-axil along the axis of origin, which is capable, at least theoretically, of indefinite growth even though it may terminate, in practice, after giving rise to a single peduncle. In Amorpheae, as I would redefine the tribe, each spike or raceme terminates its axis of origin, any apparent continuation of the stem beyond a given peduncle being in reality an axillary shoot. When the first axillary shoot is suppressed, the stem becomes simple and monocephalous. More often, however, such

axillary shoots are developed and are in turn, either once or repeatedly, stopped by an inflorescence, and when this occurs all but the last inflorescence appears *leaf-opposed.* The growth of the stems in Amorpheae is determinate, the arrangement of the inflorescences cymose and centrifugal[2]; in Psoraleeae the growth of the stem is indeterminate, the arrangement of the inflorescences racemose and acropetal. The simple axillary position of the psoraleoid inflorescence differs essentially not at all from one genus to the next; the arrangements in Amorpheae, on the other hand, are subject to relatively complex modification. In *Dalea* itself the individual spike or raceme occasionally appears axillary when actually terminating a leafless axillary branchlet, but the latter is identified as such and distinguished from a genuine peduncle by the presence of at least one stipular nodule at some point beneath the first flower. In *Eysenhardtia, Amorpha,* and *Dalea leucostachya* Gray the inflorescences are gathered (often or always) into a terminal leafless panicle of racemes or spikes, of which the central one always reaches anthesis first and is thereby identified as the terminus of the initial stem-axis, the lateral racemes being in reality terminal to reduced, leafless branchlets axillary to bracts, sometimes again ramified. In *Apoplanesia* the whole inflorescence is a leafless or remotely and irregularly leafy panicle of racemes like that of *Amorpha* but with this difference, that some racemes issue, paired with a branchlet, directly from the axil of a bract or leaf. These pseudo-axillary racemes, always interposed between a leaf or bract and a branchlet, belong to the branchlet and represent its first terminus. They are sessile due to suppression of the antecedent internode, the paired branchlet itself arising from the same node as the raceme and surpassing it in common daleoid fashion. Whatever form the whole inflorescence of Amorpheae may take, the genera have this feature in common, that the first inflorescence to reach anthesis is morphologically terminal to the stem that bears it; it may become (as often) simply and directly terminal, or the first member of an irregular monochasial series, or central to a cymosely forking, whole or partial panicle.

A secondary difference between Amorpheae and Psoraleeae, of impaired practical value because liable to too many exceptions, is observed in the foliage. The leaf of Amorpheae is basically a pinnate one and remains uniformly pinnate in all genera except *Psorothamnus, Marina,* and *Dalea.* In each of these three genera some species are characterized by leaves either pedately or palmately trifoliolate, in two *Marina* and several *Psorothamnus* further reduced to the terminal leaflet. All the trifoliolate Amorpheae, however, have existing close relatives with pinnate leaves, and their origin, by parallel reduction, is hardly in doubt. On the other hand the basic leaf-pattern of Psoraleeae appears to be trifoliolate, either palmately or pedately, but subject to numerous modifications leading on the one hand to the lupin-like leaf of *Rhytidomene* Rydb. and *Pediomelum* Rydb., or to a solitary leaflet, and on the other, perhaps by acquisition of a few accessory pairs along the leaf-stalk, to a plainly pinnate type. While the sequence from complex to simple in Amorpheae is clear enough, that in Psoraleeae is controversial, and I do not care to press the point. It seems, however, that Rydberg's suggestion that Psoraleeae show some affinity to Trifolieae (1928, p. 195), if applied to the tribe as redefined in this paper, may be worth following up.

Delimited in terms of branching and total anthotaxy, tribe Amorpheae consists of eight genera and ± 240 species, all American, primarily of the northern hemisphere

[2]The sequence of individual flowers in a given inflorescence is acropetal, alike in Amorpheae and Psoraleeae, as in all Galegeae.

and most abundant and diverse in Mexico. It embraces in addition to all Hutchinson's tribe Daleeae the first seven genera of his Psoraleeae together with *Marina*, misplaced by Hutchinson between *Psoralidium* and *Hallia* Thunb. Tribe Psoraleeae, sustaining the losses that accrue to Amorpheae becomes nearly equivalent to the genus *Psoralea* sensu Bentham, a complex group of some 200 species, certainly divisible into several genera, dispersed through temperate, arid-tropical, and montane-equatorial climates of both hemispheres, but most abundant south of the Equator in the Old World, north of the Equator in the New. The present dispersal of the two groups, like the differences in the foliage, suggests, but inconclusively, diverse origins in the remote past.

LEGUMINOSAE tribus AMORPHEAE Borissova emend. Barneby

Oil-cells present in epidermis of stems, leaves, calyx (or some of these), in some extending to the petals, the foliage in consequence "glandular-punctate," aromatic (or mephitic) when bruised; pubescence of simple basifixed hairs; inflorescence determinate; ovules 1–2, when 2 collateral, exceptionally (*Psorothamnus* sp.) 3–7; pod (except rarely in *Psorothamnus*) 1-seeded, indehiscent, continuous with the receptacle and falling together with the marcescent calyx, this sometimes modified as an aid to dispersal of the propagule; $x = 10$, 8 (exceptionally), or 7. — Small trees, shrubs, perennial and annual herbs, all American, with usually small, racemose, spicate, or capitate (white, pink, purple, blue, yellow, or particolored) flowers.

Leguminosae tribus **Amorpheae** Borissova, Novit. Syst. Pl. Vasc. **1964**: 224. 1964 (11 oct), sensu hic magnopere ampliato. — Generitypus: *Amorpha* L.
Fabaceae tribus *Daleeae* Hutchinson, Gen. Fl. Pl., Dicotyl. **1**: 413 ("*Daleae*") 1964 (3 dec).
Fabaceae tribus *Psoraleeae* Bentham emend. Hutchinson, Gen. Fl. Pl., Dicotyl. **1**: 414 ("*Psoralieae*"). 1964, pro parte, exclus. generitypo *Psoralea* L. cum arcte affinibus.

The publication date of trib. *Amorpheae* Boriss. was kindly supplied by Dr. G. P. Yakovlev (in litt., 28.II.71); that of trib. *Daleeae* Hutch. is given in Taxon **14**: 166. 1965.

Key to the Genera of the Tribe Amorpheae

1. Petals 0–5, if 5 then the inner pairs like the banner inserted on the rim of the hypanthium, if some or all petals lacking then shrubs, or the flower pedicellate, or both, if only the banner present then this cuneately contracted into a broad claw.
   2. Corolla either imperfect, the wings and keel or rarely all lacking, or if perfect and 5-petalous then not conventionally papilionaceous, the blades of the innermost pair not adherent by their exterior margins so as to contain the androecium but radially spreading distally so as to expose the anthers; claw of banner cuneate; inner petals, when present, white or yellow.
      3. Calyx-teeth shorter than or equalling the tube, essentially unchanged from full anthesis onward; leaf-pulvinus and petiolules not glandular-pustulate.
         4. Flower either 5-petalous or apetalous, not reduced to the banner alone (or if so, as rarely in *Errazurizia*, the banner itself vestigial, included in the calyx, yellowish, and dorsally pubescent).
            5. Calyx pedicellate, small, 2.5–4 mm long, its teeth mostly deltate-triangular and less than 1 mm long; petals (when present) white, nearly twice to more than twice as long as the calyx; shrubs and small

trees of Mexico, s.-w. United States, and Guatemala.

6. Corolla perfect, 5-petalous; leaflets of ovate or lanceolate type, visibly penninerved; range as given (± 10 spp.).
1. *Eysenhardtia* H.B.K.

6. Corolla lacking; leaflets of linear-involute type, costate but otherwise nerveless; high sandy deserts of s.-w. United States (1 sp.).
2. *Parryella* Gray.

5. Calyx sessile, large, mostly 5–10 mm long, the teeth ovate, foliaceous, mostly 2–3.5 mm long; petals (absent in one sp. of n. Arizona) yellow, little exserted, not over 1.5 times as long as the calyx; low shrubs, with broad, penninerved leaflets, beside the one mentioned of maritime habitat (fog-desert) in Baja California, Sonora, and Chile (4 spp.).
5. *Errazurizia* Phil.

4. Flower 1-petalous, the corolla reduced to an obovate-flabellate banner, this (often purple, blue, indigo) exserted, arched forward, marginally infolded so as to embrace the base of the androecium but not surrounding the anthers, glabrous dorsally; leaflets mostly of broad type and visibly penni-nerved; shrubs, sometimes stoloniferous and suffrutescent, highly developed in non-glaciated e. United States, extending in diminishing numbers and variety across the prairie states into n.-centr. Canada, and through s. United States to n. Mexico and the Pacific slope in California (± 20 spp.).
3. *Amorpha* L.

3. Calyx-teeth 3–5 times as long as the tube, early accrescent and in fruit becoming stiffly papery, recurved-ascending, the fruiting calyx resembling a shuttlecock and taking flight like a dipterocarp; small trees with imparipinnate leaves, the leaflets alternate and borne on petiolules glandular-pustulate like the leaf-pulvinus; petals almost as *Eysenhardtia*; s. Mexico to Venezuela (1 sp.).
4. *Apoplanesia* Presl.

2. Corolla perfect, 5-petalous, papilionaceous, the blades of the keel narrowly overlapping by their exterior margins and adherent by their faces, at full anthesis enclosing the androecium; banner differentiated into a slender claw and broad, basally cordate blade; petals all pink or purple; shrubs, of s.-w. United States and n.-w. Mexico, of desert habitat, one arborescent, one stoloniferous; flowers mostly pedicellate; ovules 2, rarely several; $x = 10$ (9 spp.).
6. *Psorothamnus* Rydb.

1. Petals normally 5, the two inner pairs epistemonous, if one or both inner pairs lacking then the plant annual, and the calyx sessile, if only the banner present this contracted into a linear claw.

7. Ovule solitary; flower always pedicellate; ribs of calyx not confluent distally into pointed arches produced into a mucro or subulate to caudate tooth but tapering out into a flat, herbaceous blade and appearing externally in the form of alternating I and Y; leaflets, always above and usually both sides, marked with sinuous, pallid lineoles ascending from the midrib at an oblique angle; hairs of the calyx and herbage (sometimes absent) not spirally twisted and not fulvescent when dry; $x = 10$; shrubs and herbs, perennial and monocarpic, of Mexico, 3 reaching s.-w. United States, 2 extending into centr. America (38 spp.).
7. *Marina* Liebm.

7. Ovules 2, collateral (but only one maturing into a seed); flower commonly sessile, but pedicellate in a few spp.; ribs of calyx commonly confluent distally into a gallery of pointed arches, the point of each arch leading to a calyx-tooth and excurrent as a distinct mucro (if this character obscure the calyx strictly sessile); leaflets green or minutely pallid-dotted, but the dots never confluent into lineoles; hairs of calyx (always present at least around and within the orifice) and herbage (often 0) spirally twisted, nearly always fulvescent when dry; $x = 7$, rarely 8; sympatric with *Marina* but extending to s.-w. Canada, Florida; circum-Caribbean; s. through the Andes from Colombia to n. Chile and n.-w. Argentina; Galapagos Is. (± 160 spp.).
Dalea Luc.

The taxonomy of the eight genera defined by the foregoing key is unevenly and incompletely worked out. The genus *Amorpha* is under continuing study by R. L. Wilbur, who has published a revision of part of it (1964). The genus *Eysenhardtia* has been revised by James M. Lang under the direction of Isely (unpublished doctoral thesis at IA). The androecial characters attributed to *Eysenhardtia* and monotypic, apetalous *Parryella* by Rydberg (1919, p. 2) are either inaccurately observed or ill-described, and more substantial differences are needed before these genera can be considered safely separate. A synopsis of *Errazurizia* (Barneby, 1962) failed to settle with finality the status of the ambiguous (because apetalous) sect. *Exostemon*, which may yet deserve generic status. The monotypic (though perhaps geographically differentiated) *Apoplanesia* presents no urgent problem. Revision of the four genera *Errazurizia, Psorothamnus, Marina,* and *Dalea* as newly defined herein to include *Petalostemum*, which together account for 212 of the approximately 240 known species of Amorpheae, brings us close to a modern census of the tribe and is an indispensable precursor of a sound reorganization of Bentham's Galegeae on a worldwide basis.

Reflections on the Phylogeny of Tribe Amorpheae

In absence of tangible evidence bearing on the course of evolution in Amorpheae, discussion of the phylogeny must be highly speculative, a projection backward from a present only dimly understood into the darkness of ages past. If that is understood, no apology is required for the remarks that follow, in which I attempt to formulate a rational basis, however subjective, for the classification of the tribe. The enquiry hinges on the assumption that it is often possible to determine, in the framework of a given group, a temporal sequence of evolutionary change: which of two given states of an attribute or of an organ is most probably anterior. If some temporal sequence, or a series of such, can be established, the taxonomy should reflect it. In speaking of a group of angiosperms so highly specialized as the Amorpheae the word primitive seems inappropriate. In avoiding it, I employ the terms prior for the anterior state, derived for the opposite.

The first list of characters is limited to that small number which seem to provide illumination at the generic level; later, in discussion of the genus *Dalea*, some others will be brought forward.

a) Woody (fruticose or arborescent) habit is prior to herbaceous.
b) The raceme is prior to the spike.
c) Plane, ± herbaceous calyx-teeth are prior to those defined by strong marginal nerves anastomosing distally into a point or seta.
d) Five petals are prior to any smaller number.
e) Sessile petals are prior to epistemonous petals.
f) A vexillum with broad claw is prior to one differentiated into a linear claw and an ovate-cordate blade.
g) Keel-blades imbricate in vernation (either free or adherent by overlapping margins at anthesis) are prior to blades valvate and coherent by their margins.
h) Two (or more) collateral ovules are prior to a solitary ovule.
i) Ten pairs of chromosomes are prior to smaller numbers.

Equal application of the criteria of priority to all eight genera of Amorpheae is not yet possible, as we lack chromosome counts for *Apoplanesia, Errazurizia,* and

Parryella, and the possibility of unforeseen numbers turning up in genera of which only some species have been sampled cannot be ruled out. The absence of keel-petals in *Amorpha* and *Parryella* introduces an unavoidable inconsistency. Disregarding these inequalities in the method, I find that *Eysenhardtia* and *Apoplanesia* score zero in the category of prior states, while *Amorpha* and *Parryella* come out ahead only on account of the apetaly already mentioned. *Errazurizia* excels *Eysenhardtia* in terms of priority only insofar that the flowers are sessile. *Psorothamnus* can have either sessile or pedicelled flowers; apart from this character it stands posterior to the obviously related *Errazurizia* in its slenderly clawed banner. By contrast with these six basically fruticose or arborescent genera, *Marina* and *Dalea* collectively exhibit many derived features. Most obvious, of course, are the epistemonous petals, accompanied often, but not always, by development of a herbaceous, finally monocarpic life-form. All Marinae preserve a racemose inflorescence and imbricately adherent keel-petals and (so far as known) ten pairs of chromosomes; the genus is nevertheless marked by the derived feature of a solitary ovule, nowhere duplicated in the tribe. The genus *Dalea* is so diverse internally that in several categories it cannot be scored on a yes-and-no basis. However, the herbaceous habit is fequent and the raceme rare; the calyx-teeth are almost uniformly of the derived type; and the low chromosome number ($x = 7$, rarely 8) is unique in the tribe. It is in *Dalea* alone that we encounter, though not throughout, a keel valvate in bud and marginally coherent. Only in its paired ovules does *Dalea* stand anterior to *Marina.*

Quite apart from specialization of their constitutent members, genera can be compared in terms of apparent maturity or senescence, qualities that we cannot doubt are real even though they are impervious to measurement. Genera composed of few members mutually separated by wide discontinuities, morphological or geographical, have an appearance of age; others, composed of species closely related or (in part or wholly) of complex groups in active evolutionary ferment, genera consequently "difficult" in the taxonomic sense, must appear by contrast young. It seems reasonable to expect that in a given context the younger genus will, on the whole, present more derived characters. Where one set of postulates is found to harmonize with the other, the likelihood that both reflect the same sequence of evolutionary events is measurably increased. Tribe Amorpheae furnishes, on the whole, an instance of this harmony.

The three genera of Amorpheae that appear from interior evidence to be most mature in the evolutionary sense are *Apoplanesia, Errazurizia,* and *Psorothamnus*, all of which were found to be poor in derived characters. The first is arborescent, monotypic, and except for probable affinity to *Eysenhardtia* taxonomically isolated. The other two are composed of few species each, four *Errazurizia* distributed through three sections, nine *Psorothamnus* arranged in four sections of approximately equivalent distinctness. Despite strikingly different floral morphology, *Errazurizia* and *Psorothamnus* have many features in common and are believed to be close relatives. The dramatically bicentric dispersal of *Errazurizia* sect. *Errazurizia*, with one species on the coast of Chile and the other, found under very similar ecological conditions of fog-desert on the Gulf of California, immediately suggests a long history[3]. Less spec-

[3]The massive size and high specific gravity of the seeds of *E. macrocarpa* preclude the possibility of dispersal by wind, wave, or avian ferry. Physical contact in the past between deserts of North and South America are required to explain the disjunction of *Larrea, Errazurizia, Prosopidastrum*, and other shrubby genera now widely partitioned by the wet tropics, but the time and place of such contact is yet to be demonstrated. Cf. Johnston, Jour. Arnold Arb. **21**: 356–362. 1940.

tacular but no less real disjunctions are encountered in the ranges of *Psorothamnus arborescens*, sens. lat., and *Ps. polydenius*.[4] The pluriovulate pod of *Ps. spinosus* hints at the possibility that the Amorpheae derive ultimately from pluriovulate ancestry, surviving only in this one genus. The heterogeneous nature of *Psorothamnus* and its wealth of unusual features has been emphasized in the taxonomic part of this paper.

By comparison with the foregoing, *Eysenhardtia* is more uniform but contains some scattered local endemism in the northwest part of its range lying between Coahuila and Baja California. Although it retains the primitive feature of pedicellate flowers, already lost by *Errazurizia*, which has nearly the same perianth, it appears substantially less mature as a genus. This youthful character is exaggerated in *Amorpha*, a genus notoriously difficult to classify. Because *Amorpha* has lost most of its perianth the floral characters scored only negatively in my assessment of derived features; the genus is unquestionably specialized. Of all the tribe, only some *Amorphae* and a few *Daleae* and *Psorothamni* have advanced so far northward (or upward) as to encounter severe frost. The status of *Parryella* is somewhat difficult to evaluate due to the extreme degeneration of the perianth. I suspect that it is a derivative of *Eysenhardtia*, perhaps not generically distinct.

The two genera richest in derived characters are also to be considered young on internal and geographic evidence, *Marina* unequivocally, *Dalea* with a few reservations. There are two main groups of *Marina*, but in each the specific distinctions tend to be finely drawn and both contain several vicariant pairs of closely related species, almost certainly of recent genesis. Some of the annual species of *Marina* reach a pinnacle of morphological specialization which can be matched, in the tribe, only by some *Daleae* likewise monocarpic. It is of interest to note that *Marina* preserves the ostensibly primitive raceme in an otherwise derived context. The few shrubby *Marinae* may well be derived from herbaceous ancestry, rather than the reverse; each species so characterized has at least one herbaceous relative still extant.

Assuming that *Dalea* is a monophyletic group, I suppose that the early stages of differentiation into diverse lines of inheritance must have occurred concurrently with or at least closely following the development of epistemonous petals and the reduction of the chromosome number. As no loss of chromosomes occurred in *Marina*, there seems a strong likelihood that the elevation of the inner petals occurred first; it might, on the other hand, have a dual origin. Since the specialized corolla and reduced caryotype, like the pubescence of spiral hairs, modified calyx-teeth, linear claw to the banner, and paired ovules are inherent characters of *Dalea*, these characters offer no further evidence toward determining the later course of evolution in the genus. The characters a, b, d, g, of my first list (above) are all that remain relevant, but these can be joined by:

j) Deciduous bracts are prior to persistent ones.
k) Keel-petals overlapping and adherent precede either free keel-petals or those valvately coherent.
l) A short androecial column is prior to a long one.
m) Eight pairs of chromosomes are prior to seven.

It will be noticed from the order of presentation, designed to reflect, so far as a linear sequence permits, my views on the phylogeny of *Dalea*, that I consider *D.*

[4]The first centers in the Mohave Desert but has outposts, remotely isolated, in n.-w. Sonora and n. Arizona; the second prevails in and around the old Lahontan Basin in w. Nevada but has outliers in s. and e. Mohave Desert and in centr. Colorado Basin in Utah.

filiciformis, sole member of subgen. *Psoropteris*, to be, in the generic context, the most primitive surviving species. Its lax raceme, short androecial column, deciduous bracts, and overlapping keel-petals are all distinctively prior states. It seems to be a relic of the evolutionary stage when incipient discontinuities between *Psorothamnus* and *Dalea* were being reinforced by an aneuploid loss of chromosomes, a loss that was arrested at eight pairs in subgen. *Psoropteris* and sect. *Theodora* of the next subgenus, but became fixed at seven pairs before *Dalea* embarked on its great expansion in numbers and in space. The coarsely veined petals of *D. filiciformis*, while epistemonous, are reminiscent of *Psorothamnus*, while the pod, as already noticed, recalls that of *Marina* sect. *Marina*. Furthermore its wide, highly interrupted pattern of dispersal in pronouncedly arid (calcareous or gypseous) habitats also carries the stamp of age.

The small subgen. *Theodora* might be interpreted either as a steppingstone between *Psoropteris* and the bulk of contemporary *Dalea* or perhaps with equal likelihood as an independent offshoot starting from near the level of specialization reached by *Psoropteris*, an offshoot notably less successful than subgenera *Parosela* or *Dalea*, or perhaps merely depleted. The subgenus is connected with *Psoropteris* through the similar bracts of sect. *Lachnostachyae* and the chromosome number ($x = 8$) of sect. *Theodora*. A biprorate pod like that of the more specialized of its two sections, sect. *Lachnostachyae*, has developed also in two sections of subgen. *Parosela* (sect. *Psoropogon* and sect. *Cylipogon*), but if any reliance can be placed on multitudinal differences in other features the likeness must be attributed to convergence.

Beyond this point all *Daleae* (so far as sampled) are at the chromosomal level of $x = 7$, with some polyploidy developing at a high evolutionary stage. There seems to have developed early in the history of the genus an important dichotomy, apparently coinciding with, possibly caused or at least encouraged by, differing methods of pollination. In one of these the closed carina and concealed androecium of *Psorothamnus*, which is preserved in *Marina* and in *Dalea* subgen. *Psoropteris* and *Theodora*, is perpetuated, at first by means of overlapping but finally by valvately coherent keel-blades. In the other the keel-petals stand aside to display the androecium openly, the flower thereby regaining a primitive quality in this one regard, although preserving the clues to intervening stages of specialization in the androecial column, this often carried out to extreme lengths.

The divergent paths of evolution followed by the two main branches appear equally long and in some respects follow parallel traces, but I cannot claim priority for either. Precedence of one is imposed by the linear arrangement, which nevertheless has the virtue of bringing out sect. *Eutropis*, which has all the marks of being the most modern and actively evolving group of Amorpheae, near the end. The flower of subgen. *Dalea*, always sessile, tends with specialization to become individually less showy. Decrease in size or degeneration of the epistemonous petals, which dwindle in relation to the banner, this always, with the one exception of *D. lanata*, plane and unappendaged, is often accompanied by condensation of the spike into a dense, conelike head of calyces interleaved with palea-like bracts; the whole inflorescence eventually resembling that of some primitive, helianthoid Asteraceae with elongate receptacle[5]. The social contract between the flowers, so closely assembled, apparently permits the simplification of the androecium which, by degeneration of the antepetalous stamens, leads to the partial pentamery of sect. *Dalea* and obligate pentamery in what has been called *Petalostemum* (sect. *Kuhnistera*).

[5] The supposedly Composite genus *Gatesia* Bertol. was based on specimens of *Dalea pinnata* var. *trifoliata* (Chapm.) Barneby.

The range of subgen. *Dalea* is limited to North America[6]. I find it suggestive that all but one member of the least specialized sect. *Thornbera* and the majority of sect. *Dalea* are found within or around Sierra Madre Occidental in western Mexico, close to but in slightly more mesic environments than the greater part of *Marina*, *Psorothamnus*, and *Dalea* subgen. *Theodora*, whereas the advanced sects. *Kuhnistera* and *Elaspora* are encountered today far off to the north and east, occupying territory marginal to the whole range of the genus.

The flower of subgen. *Parosela* is in a few species pedicelled, but these species appear to be of two types: one, exemplified by *D. caeciliae* Harms, taxonomically isolated and characterized by a plane banner, the other, exemplified by the polymorphic *D. versicolor* Zucc. characterized by the modified banner of sect. *Eutropis*. If the former are, as it would appear, relatively old species and the latter more recent, the pedicel may well be in some cases a genuinely primitive and in others a reacquired feature. The general evolutionary trend of the flower is the reverse of that found in subgen. *Dalea*, the keel tending to be magnified at the expense of the banner, which in dwindling becomes increasingly complex in structure, the blade variably thickened toward the base and often excavated there into a little obconic pit. In subgen. *Parosela* androecial degeneration has occurred only in a few morphologically advanced annual species with flowers greatly reduced in size, and where the spike is contracted into a head the flowers remain commonly few and individually showy. It is notable that in this subgenus the relatively few species in which the petals have migrated far outward on a long androecial column are characterized by a plane banner of relatively prior type. I have no key to this contradictory sequence. The relative ease with which the column can be modified is, however, clearly demonstrated by sect. *Cylipogon*, a compact and obviously natural group in which one can follow a line of transitions between the large, low-perching keel accompanied by a short-clawed banner in *D. prostrata* Lag. to the tiny, high-perching keel accompanied by an extremely long-clawed banner in *D. laniceps* Barneby. Here again we encounter ambiguity in trying to apply a rational sequence of priorities.

Extrusion of the genitalia in the monotypic sections *Viridalea* and *Prosalea*, which suggest transition between subgenera *Dalea* and *Parosela*, is interpreted as a secondary development of the latter, *Viridalea* certainly and *Prosalea* probably finding their closest relatives in sect. *Parosela*. Both have the valvate keel of the latter section, although it has lost its protective function. The prostrate, herbaceous *D. viridiflora* resembles in habit and especially in its ellipsoid, short-toothed, hyaline calyx, in everything really except the strange petal-color and the long-exserted tassel of stamens, *D. hegewischiana* and *D. rzedowskii* of sect. *Parosela*. The affinity of sect. *Prosalea* is open to controversy, the resemblance of the white petals, except for the adhesion of the keel-blades, to those of subgen. *Dalea* sect. *Thornbera* being especially notable; but its extraordinary amorpha- or eysenhardtia-like inflorescence of loose amentiform spikes raises echoes of a much more primitive type. The known chromosome number of sect. *Prosalea* ($x = 7$) weighs heavily against any direct connection with *Eysenhardtia* itself.

The subgenus *Parosela* has achieved by far the greatest spatial expansion of any comparable group of Amorpheae. It extends over the whole of temperate and arid-tropical Mexico and Central America, and thence south through the Andes to north-

[6]*Dalea leporina* (Ait.) Bullock and *D. cliffortiana* Willd. are fully established in parts of South America, the latter also in the Philippines, but were probably introduced there in Spanish colonial times.

west Argentina. Two species are interruptedly circum-Caribbean, and one is endemic on Galapagos Islands. The subgenus is poorly represented or absent over much of southern and central United States, at least in those regions where subgen. *Dalea* sect. *Kuhnistera* and genus *Amorpha* find their highest expression. Centers of speciation are found today on the sedimentary bedrock of Sierra Madre Oriental; on the volcanics of southwestern Mexico (Nueva Galicia); and in the geologically complex highlands of Oaxaca, Chiapas, and Guatemala. The Andean daleae, with few exceptions, are rather uniform morphologically and tend to succeed one another southward along the cordillera like beads on a string. There is every reason to believe that they are derived from forebears that reached the emergent Andes from an old focus of origin in southern Mexico and Central America. The exceptional species, such as *D. jamesonii* Macbr. with its pedicelled flower, or *D. galbina* Macbr., with its 20-ribbed calyx and yellow petals, are presumably autochthonous innovations of recent date.

The affinity and correct systematic position of the unique *D. trifoliata*, which is referred to monotypic subgen. *Asprolea*, remains an enigma. The open spike, large seed, and yellow petals superficially suggest *Errazurizia*, but the immense persistent bracts and the strong lateral compression of the pod (and seed) are, like the flower-structure, much closer to subgen *Parosela*. The ample round leaflets arranged in a pinnate trefoil have no match in the genus, although they somewhat resemble those of *Marina greenmaniana* (Rose) Barneby on a large and coarse scale. A chromosome count of *D. trifoliata*, when it is rediscovered, will be of more than usual interest. The home of *D. trifoliata* is in Oaxaca, and is surmised to lie in desert country; but we have no exact data on these points.

Conclusion

The portrait of Amorpheae that has been built up, in part by way of circular logic, involves numerous supposed evolutionary sequences. Most of these sequences seem to flow in the same direction and thereby reënforce each other. If I read the message in the direction of flow, and not against it, the Amorpheae most probably derive from ancestry that was fruticose (possibly arborescent), markedly xerophytic, mesothermic, and characterized by a racemose inflorescence, broad-toothed calyx, banner cuneate at base (not abruptly contracted into a linear claw), imbricate keel-petals probably free at anthesis and exposing the decandrous, monadelphous androecium, pod few- or possibly already 2-ovulate, and ten pairs of somatic chromosomes. It is further inferred that the aboriginal home of the prototypes of the tribe was in the band of arid territory conjectured to have existed through Tertiary time under the influence of dry air descending along the north edge of the wet Neotropics.

Looking back over the list of supposedly primitive features, the one that strikes me as most surprising is the form of the corolla. The botanist brought up in the North Temperate zone is preconditioned to visualize the flower of Fabaceae as basically papilionaceous, even though he may be aware of its theoretical derivation from a caesalpinioid type. To one approaching Amorpheae from the hyperborean angle of vision, the strange little flowers of *Amorpha* and *Eysenhardtia* are likely to appear as marvellously distorted versions of pea, bean, lupin, and clover. It is suggested here that these apparent distortions preserve, on the contrary, the lineaments of the ancestral Amorpheae and that the seemingly more ordinary, quasi-perfect pea-flower of

Dalea sect. *Eutropis* has acquired its papilionaceous facies at the end of a long, complex, independent detour. There is nothing to suggest similar origin for the flower of *Psoralea* or *Psoraleeae*. I must conclude, therefore, that despite some shared morphological characters the tribes Amorpheae and Psoraleeae are phylogenetically distinct and perhaps even not close kindred.

The hypothetical phylogeny developed for tribe Amorpheae is illustrated schematically in Fig. 1.

Note to the Reader

The taxonomic method followed in this revision follows conventional patterns which require no explanation. Special morphological terms are explained, at least inferentially, in the generic descriptions. The term *gland*, traditional in the literature of Psoraleoid Leguminosae, is retained for those inert epidermal oil-cells characteristic of (though not peculiar to) the group, even though it is recognized that these are structurally and functionally different from the active secretory glands to which the word commonly refers. Measurements of calyces and flower-parts are taken from moistened (reconstituted) material, those of hairs, leaves, and grosser features directly from dried specimens. Following each description, figures in Arabic followed by parenthetic small Roman numerals indicate respectively the number of collections that contributed to that description and the proportion of these seen in the living state. In citing specimens, I have modified the method to suit the case at hand. Of the commoner, more widely dispersed and hence better known species, only representative material is cited, the collections being chosen, so far as possible, to illustrate the morphological and geographical ranges of the taxon. Where ten or less than ten collections were seen, these are cited in greater detail, the degree of precision determined by particular circumstances.

SYSTEMATIC TREATMENT

Taxonomy of the Four Genera segregated from *Dalea*

As part of the introduction a key to all accepted genera of Amorpheae has already been presented; its aim is systematic rather than directly practical. The enquirer seeking direct entry to *Dalea* and its segregates will find the following simplified contrasts between the four genera more immediately useful.

Key to the Four Genera

1. Petals 5 (if exceptionally 3, one inner pair present and epistemonous).
   2. All 5 petals inserted directly or by their claw on the hypanthium rim.
      3. Corolla yellow; banner obovate, not differentiated into blade and claw; blades of keel-petals separated at anthesis to expose the androecium; Sonoran and Atacaman deserts, n.-w. Mexico and Chile. I. *Errazurizia* (p. 13)
      3. Corolla pink, purple, or blue; banner differentiated into a broad blade and slender claw; blades of keel-petals folded together to enclose the androecium; Mohavean, Sonoran and Chihuahuan deserts, Great Basin and Colorado Plateau, s.-w. United States and n. Mexico. II. *Psorothamnus* (p. 21)
   2. Only the banner inserted on the hypanthium rim, the 2 (exceptionally 1) inner pairs epistemonous.

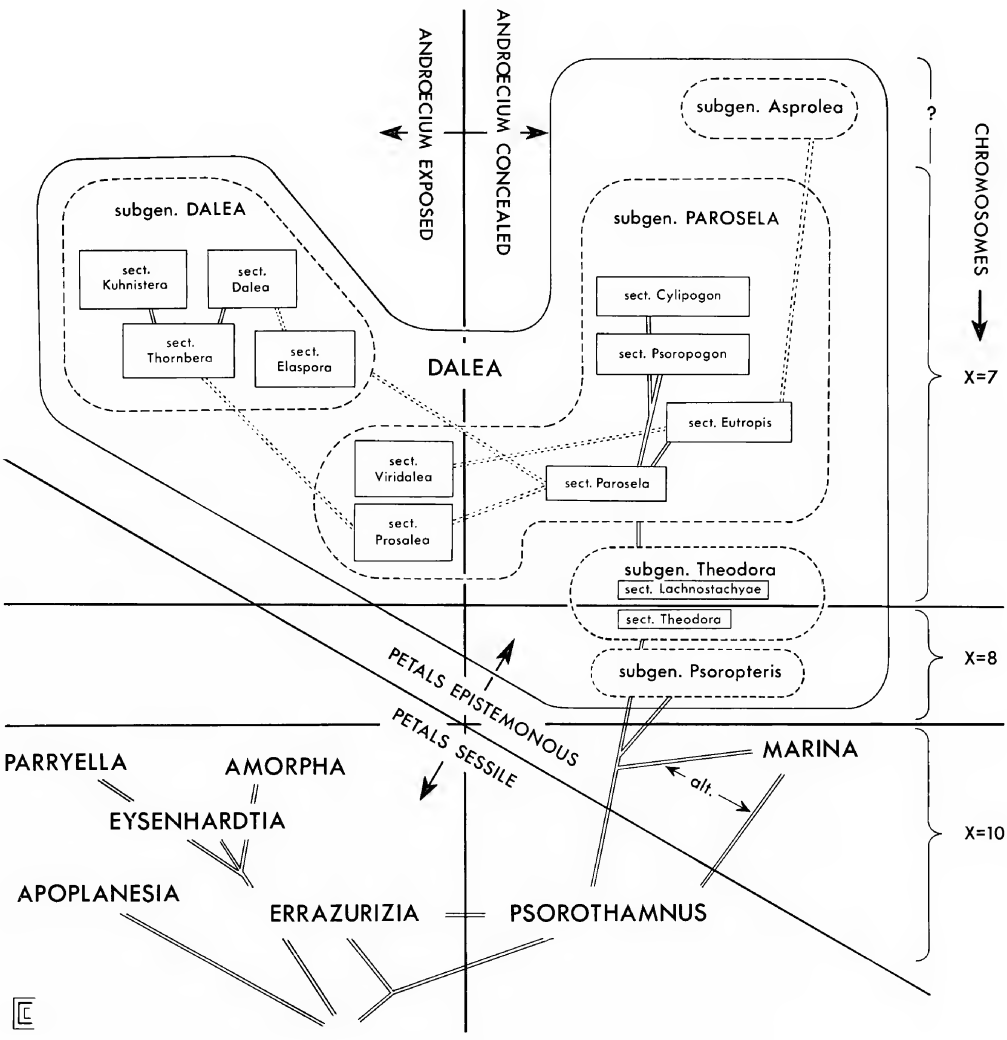

Fig. 1. Hypothetical phylogeny of tribe Amorpheae. The taxa are arranged according to increased specialization of the perianth and androecium at ascending levels of chromosome reduction. Within genus *Dalea*, the subgenera are enclosed in dashed lines, their sections in single solid lines. Parallel lines indicate direct relationships, believed certain if solid, controversial if dashed.

4. Ovule 1; flower always pedicellate; hairs of calyx (sometimes absent) neither spirally twisted nor fulvescent in age; leaflets marked on upper face with sinuous pallid lineoles ascending obliquely from midrib; ribs of calyx not anastomosing at tip of each calyx-tooth; Mexico, and extending weakly into s.-w. United States and Central America. III. *Marina* (p. 55)

4. Ovules 2, collateral; flower commonly sessile, if pedicellate then the calyx pubescent with spiral, fulvescent hairs, or the calyx-ribs anastomosing at tip of each calyx-tooth and excurrent as a mucro, or both; leaflets not lineolate; present throughout the range of *Marina* but extending to s.-w. Canada, Florida, West Indies, and s. through the Andes to n. Chile and n.-w. Argentina; Galapagos Is. IV. *Dalea* (p. 135)

1. Petals 0 (rarely a vestigial ovate banner included within the calyx); androecium far exserted; n. Arizona; cf. *Errazurizia rotundata* (p. 20).

I. ERRAZURIZIA Philippi

Small desert shrubs (to 1 m tall), pubescent and charged almost throughout with prominent or superficial glands; *leaves* pinnate, the leaflets broad, obovate-suborbicular; *inflorescence* spicate, the flowers subtended by a bract and often a pair of sessile glands representing bracteoles; *calyx* deeply campanulate, 10- or by low bifurcation of the dorsal rib 11-nerved, the nerves not anastomosing distally into closed arches, the teeth herbaceous, oblong-obovate, pubescent within; *petals* 5 or (sect. *Exostemon*) either 0 or 1, all inserted on hypanthium rim, marcescent, of about equal length, not much longer than calyx, the banner not differentiated into blade and claw, usually pubescent dorsally; *wings* and *keel* either all separate and similar, oblanceolate, obscurely auricled, or (*E. multifoliolata*) the keel-blades differentiated from the claws and lightly adherent by their narrowly imbricate outer edges; *androecium* 9- or 10-merous, monadelphous; *connective* glandless; *pollen-grains* (Mahler, 1965, fig. 2, K–L, fig. 3, A–D) 3-colporate, operculate or not; *style* stout or slender, sometimes charged below the often capitately enlarged stigma with a prominent gland; *ovules* 2, not exactly collateral, only 1 maturing; *pod* exserted from marcescent calyx and apparently falling tardily with it, obovoid, subcompressed, prominently gland-sprinkled; *seed* subcompressed, (3) 4–7.5 mm long, the hilum sunk into a little pit. — Spp. 4, disposed in 3 sections, discontinuously dispersed over deserts of w. North and South America, 2 around the Gulf of California and Pacific Baja California, 1 in Chile, 1 in n. Arizona.

Errazurizia Philippi, An. Univ. Chile *1872*. — Sp. unica: *E. glandulifera* Phil. = (syn. tax.) ***E. multifoliolata*** (Clos) I. Jtn.

The four species of *Errazurizia* are separated one from the next by wide morphological and geographical discontinuities; each has its idiosyncratic facies and all are internally uniform. They seem to be static, probably terminal products of a primitive Amorpheous stock. Within the tribe the genus *Errazurizia* forms a link between *Eysenhardtia*, which has a similarly organized, whitish or yellowish flower, and the more dalea-like *Psorothamnus*, the flower of which is papilionate and purple. In fruit *Errazurizia* is similar enough to the large-seeded species of *Psorothamnus* to have been classified by Watson in a heterogeneous sect. *Xylodalea* which united elements of both genera. The incipiently papilionate corolla of Chilean *E. multifoliolata* makes some approach to that of *Psorothamnus*, but the similarity is most easily explained, in the circumstances, as an instance of convergence, all other characters of the species pointing to a close kinship with *E. megacarpa*.

The following account is largely derived from an earlier paper (Barneby, 1962), based in turn on work by Johnston (1924) and, for the Sonoran Desert species, by Wiggins (1940). Since I transferred the anomalous *E. rotundata* from *Parryella* a comparative study of the pollen (Mahler, 1965) of all four species has shown that this may be an alien element in *Errazurizia*, more closely related to *Parryella* in which it was first described. The significance of the palynological data needs corroboration from other disciplines before any final disposition can be made of *E. rotundata*. In the first place chromosome counts for all species of *Errazurizia* are urgently required. Seeds of *E. rotundata* collected for this purpose were heavily infected by bruchid beetle-larvae, which are present in many herbarium specimens of the other species also. But this difficulty should be easily overcome.

The name *Errazurizia*, a curious one to the Anglo-Saxon eye, commemorates a prominent Chilean family of Basque extraction. Since early days of Chile's independence the gifted Errázuriz have given their country a succession of poets, writers, bishops, statesmen, and several presidents of the republic.

Key to the Sections of Genus *Errazurizia*

1. Flowers 5-petalous, the keel- and wing-petals nearly as long as the banner; *androecium* 9-merous, not or scarcely longer than calyx; *leaflets* 3–11 pairs; *pollen-grains* non-operculate; plants of coastal or lowland deserts in n.-w. Mexico and Chile.
   2. Weakly woody shrubs with pliant branches and flexible stipules; *spikes* long and narrow, 20–120-flowered, the axis mostly 5–25 cm long in fruit; *style* short and stout, not over 2.5 mm long, abruptly incurved below stigma and bearing dorsally at the bend a large gland; either Gulf of California or Chile.
      A. sect. *Errazurizia* (p. 14)
   2. Stiffly branched shrubs with rigid old branchlets, the stipules early becoming spinose; *spikes* short, ± 8–25-flowered, the axis 1.5–7 cm long in fruit; *style* long and slender, ± 5 mm long, evenly incurved, glandless, the stigma capitately enlarged; Pacific Baja California s.-ward from Isla Cedros.
      B. sect. *Psorobatus* (p. 18)
1. Flower apetalous, or only a banner present, this inconspicuous and little exserted; *androecium* 10-merous, long-exserted, nearly twice as long as calyx; *leaflets* 14–30 pairs; *pollen-grains* operculate; plants of high interior desert in n. Arizona.
   C. sect. *Exostemon* (p. 19)

A. Sectio Errazurizia

Petals 5, the keel-blades either free or narrowly imbricate and lightly adherent by the overlapping faces; *style* short, stout, abruptly incurved below the stigma and charged dorsally at the bend with a large gland.—Softly woody shrubs with pliant branches; *spikes* loosely many-flowered, narrow and elongate; *leaflets* 4–11 pairs.—Spp. 2, one of coastal n. Chile, one of Gulf of California in Baja California and Sonora.

Errazurizia Philippi sect. ***Errazurizia***. *Errazurizia* Phil. l. c., sensu str.—Sp. typica: *E. glandulifera* Phil. = (syn. tax.) **E. multifoliolata** (Clos) I. Jtn.

Key to the Species of Sect. *Errazurizia*

1. Leaflets 11–23; *calyx* 4.5–5.3 mm long, its tube 2.4–3 mm long, not or little longer than the teeth; *keel-* and *wing-petals* differentiated into claw and blade, the keel decidedly so, its blades obliquely triangular, narrowly imbricate and lightly adherent by the overlapping margins; Chile. 1. *E. multifoliolata.*
1. Leaflets 9–17; *calyx* 5.4–7 mm, its tube more deeply campanulate, 3.2–5 mm long, decidedly longer than the teeth; *keel-* and *wing-petals* subsymmetrically oblanceolate, not or very obscurely differentiated into claw and blade, the keel-blades free, at anthesis divergent apically; Gulf of California. 2. *E. megacarpa.*

1. Errazurizia multifoliolata (Clos) I. Johnston

(Plate I)

Procumbent, loosely straggling or diffuse, softly woody, resinously malodorous subshrubs forming masses of entangled stems up to 1.5 m diam but less than half as tall, the young stems and leaf-rachis densely villous-tomentulose with sinuous, subappressed and ascending hairs up to 0.3–0.55 mm long and charged with many subglobose, grain-like orange glands emergent from the vesture, the herbage greenish-cinereous, the leaflets pubescent both sides, gland-sprinkled beneath; *stipules* linear-subulate, (1.5) 2–4.5 mm long, firm but not spinescent, castaneous, thinly strigulose or distally glabrate, when young tipped with a caducous gland; *post-* and *intrapetiolular glands* grainlike; *leaves* 2–8 cm long, short-petioled, with 5–10 (11) pairs of oblong-oblanceolate to obovate or oblong-elliptic, retuse, obtuse, or truncate and gland-apiculate, shortly petiolulate leaflets 2–10 mm long; *peduncles* 1–4 cm long; *spikes* narrow, loosely 15–75-flowered, the ascending flowers all separated or some irregularly clustered, the axis becoming 5–20 cm long; *bracts* persistent or tardily deciduous, resembling stipules, 1.5–4 mm long; *bracteoles* represented by sessile glands; *calyx* 4.3–5.3 mm long, thinly gray-pilosulous, the tube 2.4–3 mm long, 2.5–3 mm diam, prominently 11-ribbed, the rib leading to the dorsal sinus double, the firm intervals charged with 1 row of ± 3–5 small blister-glands, the ovate, obtuse or gland-mucronate and thus subacute teeth all similar but the dorsal one slightly longer than the rest, 2–2.5 mm long; *petals* yellow, subcarnosulous, the banner densely pubescent dorsally, sometimes thinly so within, the inner petals glabrous; banner broadly oblong-obovate, 4.5–5 mm long, 2.1–2.6 mm wide, emarginate, around the apex involute; *wings* only a trifle shorter, obliquely oblanceolate, the blade separated from the claw by an obscure auricle; *keel* 4.1–5 mm long, the claws 1.8–2.5 mm, the obliquely triangular blades 1.7–2.5 mm long, 1.6–1.8 mm wide; *androecium* 9-merous, ± 4 mm long, the filaments unequal, the longest free for ± 2 mm, the yellow anthers 0.5–0.6 mm long; *style* stout, 1.3–2.2 mm long, somewhat dorsoventrally compressed at base and laterally so at apex, abruptly incurved below the stigma and charged dorsally at the bend with a large gland; ovules 2, not exactly collateral; pod ± 4 mm long, obovoid, nearly glabrous or thinly pilose distally, charged with many large purple-brown glands; *seed* (little known) ± 3.1–3.6 mm long. — Collections: 9 (o).

Barren hills, in fog desert, along the coast of n. Chile between Río Elqui, Coquimbo, and s. Antofagasta (lat. ± 24° 50′–30° S); reported, probably by error, from Concepción (37° S) by Bridges (no. *1290*, K). — Flowering November to January. — *Representative*: ANTOFAGASTA: *Johnston 5457* (F, GH, K), *5493* (F, GH). ATACAMA: *Werderman 159* (F, K, NY, UC). COQUIMBO: *C. Elliott 86* (K).

Errazurizia multifoliolata (Clos) I. Johnst., Proc. Calif. Acad. Sci. IV, **12**: 1043. 1924, based on *Psoralea multifoliolata* Clos ap. Gay, Fl. Chil. **2**: 87. 1846. — "[Coquimbo:]...en el camino de Arqueros..." — Holotypus, presumably P, not examined; isotypi, labelled "Chili, *Cl. Gay 272*", F, NY (both ex hb. P)!

Errazurizia glandulifera Philippi, An. Univ. Chile 1872: 688. 1872. — Chile, but no locality given. — Spm. formerly at B = Field Neg. *2037* and one at K are doubtless authentic but at least the former, from Chanarcillo, dated 1888, appears not to be isotypic; the detailed protologue is in any case decisive.

A species quite isolated in the Chilean flora and there unmistakable. The generic resemblance to North American *D. megacarpa* is close, especially in the nature of the softly woody stems, the long narrow spikes of flowers, the yellow petals, the pubescent clawless banner, and the stout incurved style charged abaxially shortly below the stigma with a prominent gland such as occurs also in some species of *Eysenhardtia*. The Chilean errazurizia differs from its congeners principally in the more obviously asymmetric corolla, which makes some approach to a conventional papilionaceous form; but the androecium is not concealed by a true carina but rather nestles in the open gutter formed by the two loosely adherent leaves of the keel. Rydberg (1928, p. 428, Pl. XXVII N) considered that separation of a monotypic *Errazurizia* from *Psorobatus* (Rydberg, 1928, Pl. XXVII M) was a matter of taste, but *E. multifoliolata* seems much more closely related to North American *E. megacarpa* than either of these is to the generitype of *Psorobatus, E. benthami*.

The transcendent interest of *E. multifoliolata* in the context of its genus and tribe is its geographic isolation in the southern hemisphere. Seeds of errazurizia are massive and sink like stones in water. The desert habitats of the species make dispersal by migratory birds unlikely. It appears more probable that the errazurizias represent dispersed elements of an ancient desert flora which had at some period in the past an overland connecting pathway, perhaps along the west foothills of the emergent Andean-Sierra Madrean axis, the same pathway that must have once connected the Larrea deserts of the northern and southern hemispheres.

In the introduction I present the hypothesis that the tribe Amorpheae is of Sierra-Madrean origin, and that its primitive members or immediate ancestors had non-papilionaceous flowers which survive in *Eysenhardtia, Apoplanesia,* and some North American *Errazurizia*. It is of interest in this connection to note that *E. multifoliolata*, which because of its incipiently papilionaceous corolla ought to be, ex hypothesi, an advanced member of its group, is also the member which exists today furthest from the supposed center of origin. A chromosome count for *E. multifoliolata* would be of greatest interest.

The plant is finely illustrated by Muñoz, Sinopsis Fl. Chil. lám. CLV. 1959.

2. ERRAZURIZIA MEGACARPA (Watson) I. Johnston

(Plate I)

Softly woody, when bruised strong-scented subshrubs up to 6–10 dm tall, the many stems forming weakly straggling thickets or more densely branched, globose bushes up to 1 m diam, tomentulose throughout with fine short entangled (and often some longer, spreading) hairs up to 0.15–0.3 mm long, the stems very densely so, white-

felted, densely charged with emergent orange or livid, grainlike or mammiform glands, the foliage either white or greenish-cinerous, the leaflets equally pubescent both sides, charged beneath with few small blister-glands; *stipules* subulate or linear, stiff but not prickly, 0.7–1.4 mm long, when young tipped with a gland, becoming dry and early deciduous; *post-petiolular glands* small, grainlike; *leaves* (2) 3–7 cm long, with ventrally flattened or shallowly grooved rachis and (3) 4–8 pairs of opposite or scattered, suborbicular-emarginate to obcordate or broadly obovate and retuse, flat, thick-textured, shortly thick-petiolulate leaflets (3) 4–10 mm long; *spikes* both terminal to branchlets and appearing leaf-opposed, sessile or nearly so, loosely or in early anthesis subcompactly (10) 15–70-, rarely up to 120-flowered, the flowers and fruits ascending, the densely tomentulose and gland-sprinkled axis becoming (3) 4–25 long; *bracts* deciduous before or at least with full anthesis, narrowly elliptic-oblanceolate or linear, navicular, herbaceous, tomentulose externally, glabrous within, gland-tipped; *bracteoles* represented by prominent blister-glands; *calyx* 5.4–7 mm long, sparsely glandular and tomentulose like the foliage, bluntly pentagonal, the campanulate tube (viewed in profile more convex dorsally) 3.2–5 mm long, 3.2–4.3 mm diam, from just above hypanthium rim 11-nerved, the ovate or oblong-ovate teeth of nearly equal length, 1.8–2.5 mm long, 1–1.7 mm wide, the ventral pair commonly a little broader than the rest, all obscurely reticulate-veined, the tube distended by the fruit, not ruptured; *petals* carnosulous, bright yellow, fading orange, finally brown and marcescent, the banner often thinly pilosulous dorsally at middle, the rest glabrous; *banner* ovate- or obovate-cuneate, emarginate or retuse, 5.8–7 mm long, 3.6–4.5 mm wide, scarcely or slightly longer than the longest calyx-tooth; *wings* and *keel-petals* all similar, the keel sometimes a trifle shorter, obliquely oblanceolate, 5–6.8 mm long, entire or obliquely emarginate, 1.3–2.4 mm wide near apex, tapering downward into the claw; *androecium* 9-merous, 3.8–4.7 mm long, the filaments (alternately longer and shorter, the dorsal one longest, free for 1.3–1.8 mm) attenuate distally, the connective glandless, the pallid anthers 0.6–0.7 mm long; *ovules* 2, not exactly collateral, only 1 developing; *pod* ovoid-ellipsoid, much exserted from calyx, 8–10 mm long, 5.2–6 mm diam, in profile somewhat oblique, the slender ventral suture less convex than the dorsal one, heavily callous-crested in the distal ⅓, the valves at first carnosulous, becoming papery, in the lower ⅓ glabrous and lustrous, thence pilosulous and densely granular-glandular, the hairs mostly retrorse proximally and antrorse distally; *style* 1.7–2 mm long, curved upward, charged at the bend with a prominent gland, the stigma capitate-peltiform; *seed* ellipsoid, compressed, 5.5–7 mm long, 3.3–4.5 mm diam, the testa smooth, ochraceous varying through castaneous-purple to nearly black, the hilum situated ± 1 mm from base, recessed into a minute well. — Collections: 33 (o).

Sandy and rocky washes, bajadas, bluffs and beaches, 5–200 m, locally plentiful around the shores of upper Gulf of California, on the Baja California side extending from vicinity of Santa Rosalía and Isla San Marcos near lat. 27° N to and shortly beyond San Felipe near 31° 20′ N, inland to Calamajué, El Mármol, and Llanos de San Julián, crossing the Gulf by way of Islas Angel de la Guardia and Tiburón to scattered stations on the Sonoran coast between Tiburón and Cabo Tepoca at ± 29° 15′ N. — Flowering February to May. — *Representative*: SONORA: *Johnston 3294* (NY, UC); *Ripley 14,315* (CAS, NY); *Gentry 4490* (UC). BAJA CALIFORNIA (Norte): *Johnston 3348* (NY, UC); *Palmer 522* (NY, UC); *Gentry 11,727* (MEXU, RENNER); *Wiggins 7706* (DS, F). BAJA CALIFORNIA (Sur): *Palmer 182* (F, NY, US); *Wiggins 11,397* (UC); *Ferris 8753* (NY).

Errazurizia megacarpa (Watson) I. Johnston, Proc. Calif. Acad. Sci. IV, **12**: 1042. 1924, based on *Dalea megacarpa* (with large pod) Wats., Proc. Amer. Acad. **20**: 359. 1885. — "Collected by C. G. Pringle, April, 1884, in Northern Sonora, 150 miles south of the boundary, on the sandy beach at the mouth of a canon opening out upon the gulf of California." — Holotypus, GH! isotypi, many dated March 29, 1884, BR, F, NY, WIS! *Psorobatus megacarpus* (Wats.) Rydb. in N. Amer. Fl. **24**: 41. 1919. *Parosela megacarpa* (Wats.) Standl., Contrib. U. S. Nat. Herb. **23**: 460. 1922.

The flower of *E. megacarpa* shown in accompanying Plate I (fig. 2) was drawn from fresh material collected by Dwight Ripley at Puerto Kino, Sonora. The figures show more clearly than the otherwise excellent ones already published by Wiggins (1940, Pl. VII) the characteristic attitude of the petals and the exposed androecium of this species, so different in pattern from the standard papilionaceous flower, but not essentially so from that of the related genus *Eysenhardtia*. The fleshy texture and clear yellow coloring of the petals are further striking features of *E. megacarpa* which on account of its white-tomentulose stems and foliage dotted with orange glands is easily recognized at all seasons.

Wiggins (1940) has described from field experience the variety of habitats in which *E. megacarpa* occurs in Baja California, not only on sands (as reported by Johnston, 1924) but also among volcanic rocks and, near El Mármol, in crevices of onyx rock-walls. The strong aroma released by the bruised foliage seems compounded of *Aloysia* and *Madia*, with tarweed prodominant; it is described as malodorous by some collectors.

B. Sectio Psorobatus (Rydberg) Barneby

Petals 5, subcarnosulous, marcescent; *androecium* about as long as calyx; *style* filiform, glandless, abruptly dilated at apex into a capitate stigma. — Low gnarled shrubs, with stiff, persistent often subspinescent stipules and ± 4–5 pairs of leaflets. — Sp. 1, of the Pacific shore of middle and s. Baja California and adjoining islands.

Errazurizia sect. **Psorobatus** (Rydb.) Barneby, Leafl. West. Bot. **9**: 210, in nota. 1962, based on *Psorobatus* Rydb., N. Amer. Fl. **24**: 41. 1919. — Generitypus: *Ps. benthami* (Brandg.) Rydb. = **Errazurizia benthami** (Brandg.) I. Jtn.

3. Errazurizia benthami (Brandegee) I. Johnston
(Plate II)

Stiffly repeatedly branched shrubs up to 1 m tall, often wider than high, the old trunks gray and furrowed, the young branches densely white-tomentulose with sinuously matted (and sometimes a few longer, spreading) hairs up to 0.1–0.35 (0.5) mm long and charged with many small grainlike, globose or mammiform, orange glands, the foliage similarly but more thinly tomentulose, the leaflets greenish-gray, equally pubescent both sides, punctate beneath; *stipules* subulate, 2–6 (9) mm long, early becoming stiffly spinose, ± spreading, at base tomentulose but distally glabrous, yellow or brownish and when young tipped with a caducous gland; *post-* and *intrapetiolular* glands small, grainlike; *leaves* (1) 1.5–4 (5) cm long, short-petiolate, with ventrally flattened, narrowly green-margined rachis and (2) 3–5 pairs of suborbicular to broadly obovate, submembranous leaflets 2–10 (12) mm long, the terminal leaflet usually largest, raised above the last pair, emarginate, the lateral ones either emarginate or obtuse, all bluntly gland-tipped; *peduncles* terminal to branchlets of current year, 0–15 mm long; *spikes* 8–25-flowered, the ascending flowers crowded at early anthesis,

later separated, the stout, tomentulose and gland-sprinkled axis becoming 1.5–7 cm long; *bracts* deciduous, narrowly lance- or elliptic-acuminate, 1.3–4 mm long, charged at tip and marginally near base with gland-grains; *calyx* 7.2–9.5 (10) mm long, thinly pilosulous-tomentulose, the hypanthium 1.2–1.7 mm deep, the tube 4.5–6 mm long, at anthesis narrowly campanulate sometimes constricted at mouth 3–4 mm diam, in fruit distended and ± 4–5 mm diam, prominently 11-ribbed (the dorsal rib double from near the hypanthium rim), the firm intervals charged with 1–6 glands in 1 (sometimes irregular) row, the oblong or ovate-oblong, gland-tipped teeth 2.5–3.7 (4) mm long, plane, of subequal length but the ventral pair sometimes broadest; *petals* subcarnosulous, marcescent, pale yellow fading orange-brown, all emarginate and revolute at apex, the slightly incurved banner sometimes thinly pilosulous dorsally, the inner petals all alike, all erect, glabrous; *banner* broadly oblong-oblanceolate, shallowly navicular, 7–9 mm long, 2.4–4.7 mm wide; *inner petals* narrowly oblanceolate or spatulate, 5.2–8.2 mm long, 1.1–2.4 mm wide; *androecium* 9-merous, 5.7–7 mm long, the longest filament free for 2–2.5 mm, the pale yellow anthers 0.6–0.8 mm long; *style* ± 5 mm long, linear, gently curved, long-persistent, glabrous above immediate base, the enlarged stigma capitate; *ovules* 2, collaterally attached but 1 ascending, 1 descending, only the latter fertile; *pod* subobliquely obovoid-ellipsoid, 7–10 mm long, 4.5–8 mm diam, the valves smooth and submembranous at base, distally papery, purplish, wrinkled, pilosulous and gland-sprinkled; *seed* (little known) ± 7.5 mm long, 5 mm diam, compressed, the testa castaneous, lustrous. — Collections: 12 (o).

Washes and rocky ledges in canyons up to ± 200 m, mostly in coastal fog-desert, along the w. coast of Baja California and adjoining islands in lat. 24° 20′–28° 15′ N, from Isla Santa Margarita n. to Isla Cedros, inland over Vizcaíno Desert to San Ignacio and Picachos de Santa Clara. — Flowering February to April, perhaps intermittently following rain at other seasons. — *Representative*: *Anthony 312* (F, MEXU, MICH, UC); *Haines & Hale* (from Isla Cedros) *in 1939* (NY, OKLA, UC); *Wiggins 7897* (F, NY, UC); *Gentry 7382, 7744* (UC).

Errazurizia benthami (Brandegee) I. Johnston, Proc. Calif. Acad. Sci. IV, **12**: 1043. 1924, based on *Dalea benthami* (George Bentham, 1800–1884) Brandg., Proc. Calif. Acad. Sci. II, **2**: 148. 1889. — "Santa Margarita Island." — Holotypus, collected Mar 3, 1889, by T. S. Brandegee, UC (herb. Brandg.)! isotypus, F! — *Parosela benthami* (Brandg.) Macbride, Contrib. Gray Herb., New Ser. **65**: 15. 1922. *Psorobatus benthami* (Brandg.) Rydb., N. Amer. Fl. **24**: 40. 1919.

Dalea megacarpa var. *biuncifera* Greene ex Vasey & Rose, Contrib. U. S. Nat. Herb. **1**: 15. 1890, in syn. (= *Palmer 744*, F, MEXU, MICH, NY, US)! nomen.

A highly xerophytic shrub, leafless during periods of drought, notable for its spinescent stipules, few, relatively large leaflets, little-exserted petals of dull yellow hue, and capitately enlarged stigma. It was first encountered by the botanists of *H. M. S. Sulphur*, and mentioned in the Botany of the expedition, but not named until rediscovered by Brandegee in 1889.

Illustrated in detail by Wiggins, 1940, pl. VI, with map of dispersal on pl. VII, fig. 13.

C. Sectio Exostemon Barneby

Petals 0, or vexillum alone present, and then not exserted from the calyx; *androecium* 10-merous, ± twice as long as the calyx, the anthers greatly exserted at full anthesis; *style* filiform, glandless. — Low shrubs with stiff branches, deciduous stipules, and 14–30 pairs of leaflets diminishing upwards along the stiff rachis of each leaf. — Sp. 1, of n. Arizona.

Errazurizia sect. **Exostemon** Barneby, Leafl. West. Bot. **9**: 210, in nota. 1962. — Sp. unica: *E. rotundata* (Woot.) Barneby.

4. Errazurizia rotundata (Wooton) Barneby

(Plate II)

Low, tortuously woody, resinously aromatic shrublets up to 3.5 dm tall and 1 m or more diam, reportedly rhizomatous, with gnarled, grayish-brown trunks up to 1 cm thick, repeatedly branched upward, the foliage and young stems densely strigulose-pilosulous with subappressed and narrowly ascending hairs up to 0.3–0.4 mm long (sometimes a few longer contorted hairs at base of leaves), cinereous or canescent, the stems, leaf-stalks, and lower face of leaflets charged with many prominent, orange or livid, grain- or prickle-shaped glands; *stipules* dimorphic, those subtending developed leaves 0.5–2.5 mm long, narrowly triangular to subulate, purplish-brown and distally glabrate, deciduous, charged at base and apex with 1 or more grainlike glands, those of inhibited axillary short-shoots closely imbricated to form globose buds; *post-petiolular glands* often present, nipple- or thorn-shaped, not regularly situated behind each petiolule; *leaves* 3–14 cm long, subsessile, with stiffly marcescent, narrowly green-margined, dorsoventrally flattened rachis and 14–30 pairs of suborbicular to oblong-obovate, obtuse or shallowly emarginate, dorsally keeled but flat, minutely gland-apiculate leaflets 1–8 mm long, these conspicuously but very gradually diminishing upward along the rachis, the terminal one smallest, elevated beyond the last pair, the larger ones pinnately nerved; *peduncles* terminal to branchlets of current year, 0–1 cm long; *spikes* shortly but rather loosely 6–15-flowered, the axis 4–15 mm long; *bracts* deciduous, narrowly lance-acuminate or subulate, 1.6–2.5 mm long, distally glabrate and glandular; *calyx* 5–6.5 mm long, at first narrowly later broadly vase-shaped, thinly pilosulous externally, densely pilosulous internally around the subsymmetrical orifice, the hypanthium 1.4–2 mm deep, the tube 3.5–4.2 mm long, prominently 10-ribbed and charged between the ribs with 1 often irregular row of 2–5 prominent glands, the oblong-obovate, obtuse or gland-apiculate teeth of nearly equal length (or the dorsal one slightly longer), 1.5–2.3 mm long, at anthesis erect, in fruit recurved; *banner* (often absent) oblanceolate, subacute to emarginate, shallowly boat-shaped but neither involute nor revolute at apex, pale yellow fading reddish, 5–5.4 mm long, 1.5–2.1 mm wide, thinly pubescent dorsally above middle; *androecium* (7) 8.5–12 mm long, the filaments united into a tubular sheath 3.5–4 mm long, free for (3.5) 5–8 mm, distally greenish-yellow, the connective glandless, the bright yellow anthers 1–1.3 mm long; *ovules* 2, not exactly collateral; *pod* ellipsoid or obovoid-ellipsoid, a trifle compressed, 9–11 mm long, cuneate at base, more abruptly contracted at apex into the persistent style-base, thick-carinate below the style, the valves densely strigulose and charged with many small grainlike, red or livid glands, becoming papery, rugulose; *seed* ellipsoid, subcompressed, (4.6) 5–7 mm long, (2.7) 3–3.7 mm wide in profile, 2–2.5 mm thick, the testa castaneous, lustrous. — Collections: 8 (iii).

Rimrock and ledges of cliffs, on red or white sandstone, sometimes engulfed in drift-sand, 1350–1500 m (4500–5000 ft), very local, known only from two small areas on creeks flowing to the Little Colorado River in Coconino and Navajo counties, Arizona. — Flowering April and early May, fruiting in June. — *Material*: Arizona. Coconino: Willow Spring n. of Cameron *Ripley & Barneby 4876* (CAS, NY), *8495* (CAS, NY, US); *Barneby 14,442* (NY). Moenave, *Deaver 3637* (ARIZ, CAS, POM, sterile). Plateau above Moenave, *Deaver & Haskell 4745* (ARIZ, sterile), *Demaree 5907* (CAS, NY, US). Navajo: cf. typus.

Errazurizia rotundata (Wooton) Barneby, Leafl. West. Bot. **9**: 210. 1962, based on *Parryella rotundata* (rounded, of the leaflets) Wooton, Bull. Torrey Club **25**: 457. 1898. — "...about five miles north of Winslow, Navajo County, Ariz., June 29, 1892, in reddish soil." — Holotypus, US!

Dalea nummularia Jones, Contr. West. Bot. **18**: 41. 1935, p. p., exclus. lectotyp. (quod = **Psorothamnus polydenius** var. **jonesii** Barneby). — Willow Spring, June 11, 1890, *Jones* (POM).

An extraordinary plant, notable for the long, multifoliolate leaves which suggest the fronds of *Notholaena sinuata* (Lag.) Kaulf., the usually apetalous flowers with their tassel of long-exserted stamens, and the relatively large spotted pod, not unlike that of *Psorothamnus arborescens*. Deaver reports that on the plateau above Moenave village the plants form rings, as though connected by subterranean stolons issuing from a dead central parent, but I could not confirm this on the cliff ledges at Willow Springs, where the plants form discrete rounded bushes, often wider than tall. Mahler (1965) found the pollen to be more like that of *Parryella filifolia* than that of other Errazurizias, suggesting that the species was placed originally in its proper genus. It seems conceivable that *E. rotundata* arose as a hybrid between *Parryella* and *Psorothamnus*, of which it has essentially the calyx and pod. Perhaps it should form a monotypic genus, but the multiple resemblances to other species of *Errazurizia* form a substantial basis for the current status.

The plant from northern Arizona (Petrified Forest, Apache County, *Harrison 5532*, US) reported by Kearney & Peebles (1942, p. 452) as intermediate between *Parryella filifolia* and *P. rotundata* is nothing more than a form of *P. filifolia* with leaflets slightly wider than average.

II. PSOROTHAMNUS Rydberg

Shrubs and subshrubs, some (especially of sect. *Psorothamnus*) only softly woody, one arborescent when adult, one herbaceous from long horizontally creeping stolons; *pubescence* usually copious, the hairs not tarnishing when dry, those of stems sometimes retrorse, those of foliage antrorse or spreading, or the leaves, rarely the whole plant, glabrate; *lenslike glands* present nearly throughout, especially abundant on stems, lower leaf-surface, raceme-axis, calyx-tube, and pod, some of them often high-convex or prickle-shaped; *branches* often lignescent in age, or the raceme-axis spinose either before or after anthesis, if before anthesis the flowers appearing lateral to spines; *leaves* mostly imparipinnate, the 2–6 (8) pairs of leaflets jointed, but either sessile or petiolulate, or more rarely confluent with rachis or (§ *Xylodalea*) the distal ones with one another, in few spp. some or all leaves 3-foliolate or reduced to a terminal caducous leaflet; *flowers* racemose or spicate, the pedicels bracteolate or charged with a pair of sessile glands, sometimes both; *calyx-tube* campanulate, the teeth unequal, the ventral pair broader and nearly always longer than the rest, sometimes partly united behind banner, the larger ones ± net-veined, rarely 1-nerved; *petals* all inserted on hypanthium rim, deciduous or rarely marcescent, wholly or partly pink, purple, violet, or vivid blue, glabrous or externally pubescent, sometimes gland-tipped; *banner* short-clawed, the claw linear or cuneate; *keel* usually as long or longer (rarely shorter) than banner, its blades narrowly overlapping by their external margins and adherent, enclosing the androecium; *androecium* 10-merous, the filaments united ± ½ (⅔) their length, alternate 5 often shorter, the connective gland-tipped or not so; *ovules* 2, collateral, or (§ *Capnodendron*) 3–7; *seed* solitary or (§§ *Winnemucca* and *Capnodendron*) 2, when 2 one disposed obliquely above the other; n = 10. — Spp. 9, highly modified xerophytes, of the Sonoran, Chihuahuan, and Mohave deserts and of desert basins within the Colorado Plateau and Intermountain United States (Nevada, s. Utah, n. and w. Arizona, s.-e. California, and Rio Grande valley in New Mexico) and n.-w. Mexico (n.-w. Coahuila, n. Chihuahua, n.-e. Sonora, and almost throughout extratropical desert Baja California).

Psorothamnus Rydb., N. Amer. Fl. **24**: 45. 1919. — Generitypus: **Ps. emoryi** (Gray) Rydb. (*Dalea emoryi* Gray).

The genus *Psorothamnus*, here expanded to embrace *Psorodendron* Rydb. (cf. sect. *Xylodalea*, infra), is related on the one hand to *Errazurizia* and on the other to *Marina*, and only through the latter, therefore more remotely, to *Dalea* as here received. It belongs with *Errazurizia, Marina, Eysenhardtia,* and *Amorpha* in the group of Amorpheae with ten pairs of chromosomes, and resembles all of these, except *Marina*, in having petals inserted directly on the hypanthium rim. It resembles *Marina*, but not others mentioned, in having an apparently normal papilionaceous keel, the two leaves of which are folded around and conceal the androecium at anthesis. The sect. *Xylodalea*, with its large, little compressed, exserted pod and single massive seed, makes a close approach to *Errazurizia*; the sect. *Psorothamnus* leans toward *Marina* in its smaller, compressed pod. However the ovule of *Marina* is solitary, those of *Psorothamnus*, like other Amorpheae, paired or exceptionally (*Ps. spinosus*) more numerous, and *Marina* has the inner petals elevated on a column continuous with the androecium, appearing epistemonous. It is this character which links *Marina* to *Dalea* sens. lat. and separates both from *Psorothamnus*.

The genus *Psorothamnus* as here redefined embraces not only all of *Psorodendron* Rydb. but also *Parosela thompsonae* Vail (misplaced by Rydberg in *Parosela* subgen. *Trichopodium*) and *Dalea whitingi* Kearn. & Peeb., described long after Rydberg's monograph and now interpreted as only varietally distinct from the last. The dichotomy stressed by Rydberg (1919, and again in 1928, p. 198, in clave) between a genus *Psorodendron* characterized by a pedicellate flower and exserted (i.e., large, errazurizia-like) pod and a genus *Psorothamnus* different in its sessile flower and included (more compressed and dalea-like) pod cannot be followed literally. The flower of *Psorothamnus polydenius* (Torr.) Rydb. is often shortly pedicelled, while the fruit of *Psorodendron kingii* (Wats.) Rydb., though pedicelled, does not surpass the calyx-teeth. Moreover *Psorothamnus thompsonae* (Vail) Welsh & Atwood, with a compressed included pod combined with the long pedicel of *Psorodendron* but the peculiar retrorse stem-pubescence found otherwise only among original members of *Psorothamnus* sens. str., sits squarely between the two. It should be mentioned that W. F. Mahler, working primarily from the palynological angle, arrived independently at the same inclusive generic concept.

Morphological features not or only rarely duplicated elsewhere in tribe Amorpheae but seen in one or more (but not all together in any one) species of *Psorothamnus* are both numerous and, in some instances, suggestive of intergeneric relationships: creeping rhizomes (*Ps. kingii*); leaves all (*Ps. spinosus*), most (*Ps. scoparius*), or some (*Ps. emoryi*) reduced to the terminal leaflet; stem-pubescence retrorse (sect. *Psorothamnus* except *Ps. emoryi*); leaflets decurrent on the rachis (*Ps. arborescens, Ps. emoryi,* but both in part only); axis of the raceme (sects. *Capnodendron* and *Winnemucca*) or of sterile branchlets immediately preceding it (*Ps. thompsonae*) spinose; pedicels bibracteolate (in all but sect. *Psorothamnus*, where bracteoles are represented, as in all species of *Marina*, by sessile glands); petals marcescent (*Ps. thompsonae*); more than one seed maturing from a pair of collateral ovules (*Ps. kingii*); more than 2 ovules (*Ps. spinosus* always, *Ps. thompsonae* occasionally). The large pod and massive seed of sect. *Xylodalea* are closely matched in *Errazurizia*, of which the one Chilean species has, unlike the North American, keel-petals lightly adherent by the overlapping margins, at least in bud. The small compressed pod of sect. *Psorothamnus* hardly differs from that of some *Marina*. However these odd or aberrant features of individual *Psorothamnus* species are, as implied in the list, poorly correlated, and contribute little to clarification of cross-relationships within the framework of the genus. Note, for example, how the characters of the inflorescence and the incidence of a glandular connective cross over, as it were cancelling each other out.

A notable feature of *Psorothamnus* is the high percentage of taxonomically isolated types. Despite a constitution, at the generic level, adapted to extreme desert conditions, the genus has developed no monocarpic species, as has occurred in *Dalea* and *Marina* under comparable climatic stresses. The generally woody character of its members, their mutually remote taxonomic relationships, and the connection via sect. *Xylodalea* with the apparently relict genus

Errazurizia (and thence with *Eysenhardtia*) mark *Psorothamnus* as probably ancient and primitive relative to the two epistemonous genera of Amorpheae. It is, however, evidently closer kin to *Marina* than to *Dalea* itself.

Key to the Sections of *Psorothamnus*

1. Axis of the raceme contracted beyond the last flower into a spine, the flowers appearing lateral to a terminal branchlet.
   2. Arborescent when adult, becoming over 2 m tall, leafless at anthesis; *ovules* (3) 4–7; *anther-connective* gland-tipped; Colorado Desert in s.-e. California to extreme s.-w. Arizona and n.-e. Baja California; monotypic (*Ps. spinosus* (Gray) Barneby). A. sect. *Capnodendron* (p. 23)
   2. Herbaceous from creeping stolons, less than 5 dm tall, the pinnate foliage persisting; *ovules* 2; *anther-connective* glandless; desert basins of n.-w. Nevada; monotypic (*Ps. kingii* (Wats.) Barneby). B. sect. *Winnemucca* (p. 26)
1. Axis of raceme florigerous to apex, becoming spiny (if at all) only after the pods have fallen, the flowers appearing normally racemose or spicate.
   3. Pod greatly exserted, its body 7–10 mm long, the seed 4.5–8 mm long; flowers loosely racemose, the pedicels 2-bracteolate under the calyx; *anther-connective* glandless; *vesture* of stem (if present) upwardly appressed; *petals* glabrous; spp. 3, of the Mohave and Colorado deserts in California, w. Nevada, and w. Arizona, s. into extreme n. Sonora and n.-w. Baja California, feebly e. to the Colorado Plateau in s.-e. Utah and n. Arizona. C. sect. *Xylodalea* (p. 27)
   3. Pod scarcely or not exserted, its body 2–4.5 mm long, the seed less than 3 mm long; *flowers* either racemose or spicate, but the pedicels, if present, charged at apex with glands, not bracteoles; *anther-connective* gland-tipped; either the *flower* subsessile, or the *petals* externally pubescent, or stems retrorsely hairy, or some of these features present in some combination; spp. 4, covering the range of the genus in the Sonoran, Chihuahuan, Mohavean and Intermountain deserts of United States and n.-w. Mexico. D. sect. *Psorothamnus* (p. 41)

A. Sectio Capnodendron Barneby

Flowers racemose, the pedicels 2-bracteolate, borne apparently lateral to branchlets, the common axis of the raceme produced beyond the last flower as a stout spine; *ovules* (3) 4–7, mostly either 2 or 3 pairs; *connective* of anthers gland-tipped. — Arborescent shrubs, intricately thorny-branched, the small leaves reduced to the terminal leaflet and deciduous before anthesis; *petals* indigo-blue, glabrous, the claw of the banner charged distally with 2 callosities. — Sp. 1, of low elevations in the northwestern Sonoran Desert.

Psorothamnus sect. **Capnodendron** Barneby, sect. nov., based on *Asagraea* Baill., Adansonia **9**: 232. 1870 (non *Asagraea* Lindl., 1839). — Generitypus: *A. spinosa* (Gray) Baill. [*Dalea spinosa* Gray, *Psorodendron spinosum* (Gray) Rydb.] = **Psorothamnus spinosus** (Gray) Barneby.

The section consists of the taxonomically isolated *Ps. spinosus*, unique in tribe Amorpheae in having 3–7, not 1 or 1 collateral pair of ovules. Its nearest, but hardly close relative in *Psorothamnus* is the equally isolated *Ps. kingii*, with which it shares a common type of inflores-

cence, the axis of the raceme in both being modified into a stout thorn which seems to bear the flowers laterally below the sharp, wounding tip. It is suggestive that the ovary of *Ps. kingii*, although 2-ovulate in the manner of *Dalea*, often matures two fertile seeds, one of which, although inserted opposite the other, becomes displaced, eventually standing above its twin, like the seeds of *Ps. spinosus*. The great differences in stature and habit of growth, the pinnate foliage, and the eglandular connective between the anther-sacs nevertheless set off *Ps. kingii* decisively from the Smoke Tree, *Ps. spinosus*. The reduced foliage of *Ps. spinosus* might be interpreted as evidence of a genetic link with *Ps. scoparius* of sect. *Psorothamnus*, but the latter is fundamentally different in its normally racemose inflorescence, collaterally paired ovules, and in practice altogether different in gross appearance. It seems more likely that the apparently leafless stems are expressions of convergent or parallel evolution.

1. Psorothamnus spinosus (Gray) Barneby
(Plate III)

Small, round-headed trees, flowering as bushy shrubs at a stature of ± 1.5 m, attaining within a few years a stature of 7, exceptionally 10 m, with a single or few trunks up to 1 dm diam (mostly much less), the old bark pale gray, the repeatedly, stiffly and closely forking branches densely silvery-silky with short, forwardly appressed or subappressed hairs (in age rarely glabrescent and greenish), charged distally with large rounded or more prominent and prickle-shaped, orange glands, the ultimate branchlets all in reality raceme-axes tapering into a stout, glabrous brownish or yellowish thorn, the whole appearing leafless and during the greater part of the year truly so; *leaf-spurs* short, charged on either side with a large gland; *stipules* 0.2–1 mm long, broadly deltate, dorsally silky, glabrous within, deciduous; *leaves* of mature plants shed shortly before or after anthesis, all reduced to a terminal, petiolulate, oblanceolate or cuneate-oblanceolate, truncate-retuse, thick-textured leaflet 2–22 mm long, strigulose both sides, bluntly gland-tipped dorsally; *seedling leaves*, present only during the first few months of growth, broadly oblanceolate, 2–6 cm long, 0.5–2 cm wide, glaucescent, faintly 3–7-nerved, the margins glandular-crenulate or shallowly gland-toothed; *racemes* loosely 5–15-flowered, the axis (including the terminal spine) 1–4 cm long; *bracts* fugacious, ovate, 0.5–0.8 mm long, silky dorsally; *pedicels* 0.7–1.8 mm long, charged near apex with a pair of linear, silky bracteoles, sometimes also by a pair of glands; *calyx* 4.5–5.2 mm long, densely silky-strigulose, the hypanthium 1.2–0.7 mm deep, the bluntly angled and shallowly pleated tube 3–3.8 mm long, the ribs little prominent, the firm intervals charged above middle with 1 large (rarely 2, or exceptionally 0) obtuse or prickle-shaped gland, the herbaceous lobes ovate, gland-mucronulate, slightly unequal, the ventral pair largest, (1) 1.2–1.7 mm long, not or scarcely united behind the banner and the orifice therefore subsymmetrical, all recurved in age, faintly reticulate-nerved, densely silky-pubescent internally; *petals* indigo-blue, eglandular or rarely the banner charged with a subapical gland, glabrous; *banner* 6.4–7.5 mm long, its incurved claw ± 1.5 mm long, the ventral face commonly ridged lengthwise and the ridges terminating in callosities, the blade obcordate, auriculate at base, strongly recurved, 5.2–6.6 mm long, ± 5–7 mm wide; *wings* 7–8.8 mm long, the claw 2.2–2.6 mm, the obovate to broadly oblanceolate, obtuse or emarginate blade 5.5–6.8 mm long, (2.4) 3–4.5 mm wide; *keel* 9.2–11 mm long, the claw 2.4–3.2 mm, the obovate blades 6.6–8.2 mm long, 4.2–5.4 mm wide, the auricle small or almost 0; *androecium* 9.5–11.5 mm long, the filaments free for 4.1–4.9 mm, the connective gland-tipped, the anthers 0.75–1.1 mm long; *pod* as long or slightly longer than the calyx, plumply compressed-

obovoid, the firm valves pilosulous distally and charged mostly below middle with several blister-glands; *ovules* (3) 4–7, but only 1 or 2 developing into seeds; *seeds* (if 2, then superposed, not opposite) little known, ± 3 mm long, the testa smooth, brown, purple-speckled. — Collections: 53 (o).

Sandy and bouldery washes in the Larrea belt, mostly below 240 m (800 ft) but up to 400 m in extreme s. Nevada and 430 m in Baja California, descending in Salton Depression to −70 m, widespread over the Colorado Desert but apparently most abundant along its western periphery, from Coachella Valley e.-ward to both banks of the Colorado River, there n. just into the s. point of Nevada and the s. margins of Mohave Desert near the sink of Mohave River, s.-e. to the big bend of Gila River in Maricopa County, Arizona, to extreme n.-w. Sonora, and along the foot of Sierra San Pedro Mártir in Baja California (Edo) into the *Idria* deserts, reaching nearly to 28° S between Calamajué and Calmallí, and in the Gulf as far as Isla San Angel de la Guardia near 29° 30 (but unknown from these latitudes in Sonora). — Flowering late May to mid-July, in fruit July and August, flowering again, rarely and less prolifically, in October-November. — Map (essentially complete in outline except for extension n. along Colorado River into s. Nevada): Shreve & Wiggins, Veg. Fl. Sonoran Des. **1**: 178. — *Representative*: UNITED STATES. NEVADA. Clark: *Gullion 365* (OKLA, UC). CALIFORNIA. San Bernardino: *Jepson 5212, 15,539* (UC-JEPS). *Alexander & Kellogg 1253* (UC). Riverside: *Duran 3499* (NY, UC, WIS); *M. E. Jones* (from Palm Sprs) *in 1926* (NY, POM, UC). San Diego: *Abrams 3980* (NY); *Gander 3205, 4701* (SD). Imperial: *Peebles 1* (NY). ARIZONA. Mohave: *MacDougal 12* (NY). Yuma: *Peebles 12,029* (NY); *Purer 5655* (SD). Maricopa: *Peebles & Parker 14,802* (NY, US). Pima (extreme w.): *Mearns 2767* (NY). MEXICO. SONORA. *Wiggins 8366* (US). BAJA CALIFORNIA (Norte): *Chambers 513* (SD, UC); *Moran 10,340, 11,559* (SD).

Psorothamnus spinosus (Gray) Barneby, comb. nov., based on *Dalea spinosa* (spiny) Gray, Mem. Amer. Acad. II, **5** (Pl. Thurb.): 315. 1854. — "Arroyos on the Gila; and on the Californian desert west of the Colorado, where it was also gathered by Fremont, in 1849...." — Holotypus, *Thurber 684*, GH! isotypus, NY (herb. Torr., herb. Thurb.)! paratypus (*Fremont in 1849*), NY (herb. Torr.)! — *Asagraea spinosa* (Gray) Baillon, Adansonia **9**: 233. 1870. *Parosela spinosa* (Gray) A. Hell., Catal. N. Amer. Pl. ed 2, 7. 1900. *Psorodendron spinosum* (Gray) Rydb., N. Amer. Fl. **24**: 45. 1919.

The Smoke Tree, *Ps. spinosus*, an arborescent bush characteristic of the bed or banks of washes and intermittent streams on the outwash fans of low desert mountains, is familiar to most travellers in its leafless and flowerless state, rising in distant view as a puff of silvery vapor from the vivid greens of larrea and palo verde but resolving at close quarters into a lattice of stiffly divaricate branchlets running out into smooth stout thorns. The leaves of the adult tree, produced only on young growth following fall or winter rains, are small, simple, and fugacious, adding little by way of mass to the rounded head or to the shadow cast by it. For three fourths of the year the task of photosynthesis falls to the branchlets of the current year, which remain green beneath their gray or silvery vesture. Seedlings, however, bear during their first season ample oblanceolate leaf-blades up to 5 cm long, permitting rapid growth during the few weeks when water is available to the young root. The Smoke Tree has been described as shy-flowering, but (disregarding years of extreme drought) is only late-flowering, and seldom collected in flower or fruit. Flower-buds do not form until mid-May or early June; they are, however, extremely numerous, when expanded clothing all the young growth with a robe of vivid indigo. Seed is abundant but hard-shelled, and seems to germinate only after it has been ground by water-moved sands and gravels of the torrent bed, sands which later overwhelm and smother many of the young plants. Despite its hard, close-grained wood and considerable stature the Smoke Tree is said to mature rapidly and perish early. On the desert the fallen branches are used for fuel, when burned giving an aromatic smoke.

Handsome portraits of the often photographed Smoke Tree may be seen in McMin Illustrated Manual of California Shrubs, fig. 241; and Jaeger, Desert Wild Flowers, fig. 23 and in splendid color in de Wit, Knaurs Pflanzenreich in Farben **1**: fig. 181. 1964. Best of a is Faxon's superb lithograph in Sargent, Silva N. Amer. **3**: t. CXI. 1892.

B. Sectio WINNEMUCCA Barneby

Inflorescence of sect. *Capnodendron*, the raceme-axis contracted beyond the la flower into a spine; *ovules* 2, collateral; *anther-connective* glandless. — Subherbaceou the stems arising singly from creeping, cordlike stolons; *leaves* pinnate, the leaflet 1–4-jugate, mucronate at apex; *petals* blue, glabrous, the banner without callosities. - Sp. 1, of dunes in the Lahontan Basin, n.-w. Nevada.

Psorothamnus sect. **Winnemucca** Barneby, sect. nov., a sect. *Capnodendro* quoad racem axin in spinam abeuntem simili habitu herbaceo, caulibus e stolonibus late repentibus singu latim hinc inde emissis, antherarum connectivo eglanduloso, necnon ovulis binis collateralibu abstans. — Sp. unica: **Ps. kingii** (Wats.) Barneby (*Dalea kingii* Wats.).

A monotype of singular idiosyncratic appearance and notably localized dispersal, unlik all other *Psorothamnus* in its creeping reddish stolons, from which arise singly and seriall the short herbaceous, divaricately branching stems. Except that the flowers are less numerous mostly 1–4 rather than 5–15 to a raceme, the inflorescences of *Ps. kingii* and *Ps. spinosu* are essentially alike, the axis in each case running out into a spine beyond the last flower, an the flowers themselves bibracteolate. The expanded imparipinnate foliage of *Ps. kingii* is mor suggestive of the always fruticose sect. *Xylodalea*, especially that of *Ps. arborescens* var *minutifolia*, but the stout yellow mucro at apex of each leaflet is again unique.

2. PSOROTHAMNUS KINGII (Watson) Barneby
(Plate III)

Subherbaceous, low and diffuse, the stems arising singly from buds on widely creep ing reddish cordlike stolons running at a depth of 1–10 cm below level of the sand ± pilosulous with straight, narrowly ascending and subappressed white hairs up t 0.5–0.8 mm long, the lower stem and early leaves thinly so or sometimes glabrous bright yellow-green, the leaflets of upper leaves densely pubescent, canescent above greener and gland-punctate beneath; *stems* above ground 1–3.5 dm long, at almos every node divaricately branched, becoming stiff, pustulate with yellow glands, th distal branchlets and raceme-axes modified into tapering, yellow-pointed spines 1– (3.5) cm long; *leaf-spurs* up to 1 mm long; *stipules* ± dimorphic, those subtendin leaves subherbaceous becoming papery and yellowish, narrowly subulate to linea attenuate, (1) 1.5- 5 mm long, subglabrous, but some low on the stem broadly oblance olate, up to 1 cm long, coarsely 1–3-dentate; *leaves* 1–4.5 cm long, short-petiole with margins, pustular rachis and 1–4 (the main cauline leaves with 2–4, the uppe ones with 1–2) pairs of ovate to rhombic-ovate or oblong-elliptic, stoutly yellow mucronate leaflets (3) 5–12 (15) mm long, their margins thickened, subrevolute, entir to obscurely undulate or rarely dentate; *racemes* sessile or almost so, loosely 1– (5)-flowered, the first flower borne at or just above base, the axis running out into glabrous yellow spinule; *bracts* resembling stipules, 1.5–2.5 mm long; *pedicels* slende

1–2.3 mm long, charged at apex with a pair of bracteoles 0.6–2.3 mm long, often accompanied by a pair of glands; *calyx* 7–8.2 mm long, thinly strigulose-pilosulous externally, the inner face of the teeth silky-canescent, the disc 1–1.5 mm deep, the vase-shaped tube 3.8–4.2 mm long, herbaceous throughout but the intervals a little thinner than the inconspicuous ribs and charged with 1 row of 2–7 glands of varying sizes, the teeth unequal, the ventral pair (united no higher than the rest) ovate, acute, 3–4.2 mm long, 1.8–2.6 mm wide, about twice wider and a little longer than the lanceolate lateral and dorsal ones; *petals* glabrous, blue, the banner charged with a large subapical gland, the keel and often the wings glandless; *banner* 7–9.2 mm long, obovate-cuneate, deeply notched, the blade 5.2–7.4 mm wide, evenly curved backward, tapering downward into the scarcely differentiated claw; wings as long or a trifle longer, 7.8–9.3 mm long, the claw 3–3.6 mm, the oblong, obtuse or obliquely emarginate blade 5–6.6 mm long, 3.2–3.9 mm wide; *keel* 8–10 mm long, the claw 3–3.8 mm, the broadly obovate blade 5.2–6.5 mm long, 3.4–4 mm wide; *androecium* 8–9.5 mm long, the filaments free for 3.2–4.4 mm, the anthers 0.8–1.5 mm long; *pod* in profile obliquely, rather narrowly obovate in outline, (3.5) 4–5.5 mm long, the style-base lateral slightly below apex, the valves in the lower half hyaline, glabrous, distally papery, pilosulous, sprinkled with small, pale yellow glands; *seeds* 1 or 2, when 2 one raised obliquely beyond the other, 3.1–3.8 mm long, 2.1–2.5 mm diam, pallidly olivaceous with a linear brown patch extending from scar half way to base; $2n = 20$ (Mosquin). — Collections: 11 (i).

Sandbanks and hollows of hummocked dunes, ± 1300–1400 m (4350–4700 ft), forming extensive colonies but extremely local, known by modern collections only from the great dunes in the piedmont of Santa Rosa Mts. on the w. bank of Little Humboldt River (Paradise Valley) and from s. end of Silver State Valley at points 8–20 mi n.-w. of Winnemucca, Humboldt County, Nevada, but described from Hot Springs Mts, s.-w. of Brady's Hot Springs in Carson Sink, n.-w. Churchill County ± 180 km s.-w. of Paradise Valley), to be sought elsewhere in lower Humboldt River Valley. — Flowering June to August, in fruit July to September. — *Representative*: NEVADA. Humboldt: *Maguire & Holmgren 10,603, 22,486* (NY, UC); *Holmgren f. & Reveal 2877* (NY, widely distrib.); *Ripley & Barneby 9350* (CAS, NY); *Breene 298* (NY, UC); *Holmgren f., Fay & Bethers 4196* (NY, widely distrib.).

Psorothamnus kingii (Watson) Barneby, comb. nov., based on *Dalea kingii* (Clarence King, 1842–1901, geologist and explorer) Wats. in King, Geol. Expl. 40th Parallel, Botany 64, Pl. X, fig. 1–3. 1871 ("*Kingii*"). — "Found on drifted sands in the upper canons of the Hot Spring Mountains, Nevada; 7000 [but surely below 5000] feet altitude; August... (252)." — Holotypus, *Watson 252* [but actually collected in 1867 by W. W. Bailey, first botanist of the King Expedition], GH! isotypus, NY! — *Parosela kingii* (Wats.) Rydb., N. Amer. Fl. **24**: 42. 1919.

C. Sectio XYLODALEA (Watson) Barneby

Flowers racemose, the axis florigerous to apex, sometimes persistent after fall of the flowers but not spiny; *bracteoles* 2; *petals* vivid indigo- or violet-blue, glabrous, deciduous, glandless; *anther-connective* glandless; *pod* greatly exserted from calyx, its body 7–10 mm long; *ovules* 2, collateral, but seed solitary, very large, 4.5–8 mm long. — Shrubby, either erect and bushy or low and straggling, the branchlets often lignified in age and subspinescent; *leaves* normally pinnate, or pinnate with leaflets ± decurrent on rachis, or some reduced to a trefoil or to lanceolate or linear-filiform phyllodes.

— Spp. 3, widespread over the Colorado and Mohave deserts of s.-e. California, adjoining s.-w. Nevada, w. Arizona, extreme n.-w. Sonora, and the Gulf slope of n. Baja California (Edo), 2 of them extending locally e. into canyonlands of the Colorado Basin in n. Arizona and s.-centr. Utah.

Psorothamnus sect. **Xylodalea** (Wats.) Barneby, comb. nov., based on *Dalea* sect. *Xylodalea* Wats., Proc. Amer. Acad. **11**: 132. 1876, char. emend., exclus. spp. nonnull. — Sp. lectotypica: *Dalea californica* Wats. = **Psorothamnus arborescens** var. **simplifolia** (Parish) Barneby.

Psorodendron Rydb., N. Amer. Fl. **24**: 41. 1919. — Generitypus: *Ps. johnsoni* (Wats.) Rydb. = (syn. tax.) **Psorothamnus fremontii** (Torr.) Barneby.

The section *Xylodalea* is set off from the rest of the genus by the combination of a normally racemose inflorescence, bracteolate pedicels, a glandless anther-connective, large exserted pods, and a massive seed. In size and form of the fruits it resembles *Errazurizia*, but is entirely different in the unguiculate banner, purple-blue petals, and concealed androecium. Within the section the species are very closely inter-related. Apart from small differences in the relative proportions and size of the calyx the flower remains essentially uniform and the visually arresting differences in pubescence and in size, shape and number of the leaflets are unstable and thus less suited than the literature of the group suggests to serve as differential characters.

I follow tradition in maintaining *Ps. schottii* in the rank of species. This is often said to differ from its kindred in having none but simple leaves; trifoliolate leaves are, nevertheless, not at all uncommon and individual leaves of this sort closely resemble the simpler leaves of *Ps. fremontii* var. *attenuatus*. Furthermore simple leaves or phyllodia occur in some populations of *Ps. arborescens* var. *simplifolius* at points in Coachella Valley where the range of the latter overlaps that of *Ps. schottii*. Foliage characters do not suffice to separate *Ps. schottii* convincingly from other *Xylodalea*; in practice, however, its taller, bushy growth combined with a proportionately short and short-toothed calyx render it easily recognized. This species varies from almost glabrous up to the internally silky calyx-teeth into a densely silky-canescent phase often recognized as *Dalea schottii puberula*. Plants of the pubescent type have been found only in a small segment of the species-range, and even there do not replace the more usual, green-stemmed form. In this frame of reference the pubescence variants are readily recognized as such and prepare the observer for equivalent and sometimes more extreme instability in vesture that will be encountered in *Ps. arborescens* and in several species of sect. *Psorothamnus*.

The taxonomic history of the residue of sect. *Xylodalea* is voluminous and complex. Handsome shrubs, mantled in spring with prolific indigo blue or violet purple flowers, they have been studied and described repeatedly in the context of floristic and monographic revisions. In whole or in great part the group has been studied by Vail (1897), Abrams (1910 and 1944), Parish (1913), Rydberg (1919), Jepson (1925, 1936), Munz (1935, 1959), McMinn (1939), L. Benson (1954, summary), and Wiggins (1964), each of whom arrived at his own circumscription of entities; in consequence the taxonomy has become increasingly murky and the synonymy inordinately complex. Since Rydberg's study for *North American Flora* the problems inherent in *Psorothamnus* have not been reëxamined in the context of tribe Amorpheae or, in particular, in relation to *Dalea* sens. lat., a context in which pubescence-characters require a most cautious evaluation. Reviewing the literature of the group one finds a concensus of long standing that *Dalea arborescens*, characterized by a dense villous-tomentulose vesture and relatively few and broad, commonly decurrent leaflets, is a species locally endemic to the south-central Mohave Desert and specifically distinct from a widespread, polymorphic, and partly sympatric *D. fremontii*, which has been divided up, according to taste, into several geographic varieties. A strict application of preconceived criteria required Jepson to admit that *D. arborescens* occurred not only in the type-region about Barstow, but also disjunctly far northward in Mono County (near Benton). It is curious, to say the least, that the glabrescent, otherwise very similar *D. fremontii* var. *saundersii* was cited from these same two stations.

Looking further into the matter, however, it is found that the so-called var. *saundersii* of Barstow and Benton resemble each other less closely in details of foliage and flower-size than they resemble the sympatric form of villous-tomentulose "*arborescens*." Bearing in mind what has been said of *Ps. schottii* and what will be described below under the heading of *Ps. arborescens* var. *pubescens,* a particularly clear example due to its geographic segregation, one can reinterpret Jepson's *D. arborescens* as a selection of densely gray-villous individuals not directly related to each other but to the glabrate or glabrescent populations of which they form a part. Once the stumbling-block of pubescence has been cleared away, a new assessment of affinities in sect. *Xylodalea* becomes possible, the concepts that emerge conforming, moreover, to comprehensible patterns of distribution.

Key to the Species of Sect. *Xylodalea*

1. Leaves all or mostly simple, reduced to the linear rachis and over 1 cm long, rarely a few 3-foliolate, the lateral leaflets then also linear and resembling the rachis; relatively *tall shrubs* (1–2 m) of the w. and s. Colorado Desert, from Palm Springs s. into n.-w. Baja California and e. just into s.-w. Arizona; *calyx-teeth* 1–1.7 (2) mm long; *seed* 6–8 mm long. 3. *Ps. schottii.*
1. Leaves all or mostly 3–13 (17)-foliolate, rarely some of the uppermost (exceptionally all) simple, but if simple then lanceolate and less than 1 cm long; *lower shrubs*, mostly less than 1 m tall, of the Mohave Desert, extending to extreme n. and e. Colorado Desert, s. Nevada, s.-centr. Utah, and n. Arizona, disjunct in n.-w. Sonora; *calyx-teeth* (at least the ventral pair) up to 2–4.5 mm long; *seed* 4.5–6 mm long.
   2. Pod either glabrous or pilosulous, the faces charged with relatively few and large, round or elliptic blister-glands separated one from the next by spaces as wide as their own diameter, never confluent; Mohave Desert (except the calcareous mountains in far e. San Bernardino County) n. through Death and Owens valleys to Esmeralda County, Nevada, and s. around the foothills of San Bernardino Mountains into the head of Coachella Valley, and to San Jacinto Valley w. of the desert proper; isolated along the Colorado River in n. Coconino County, Arizona, and near the Gulf of California in n.-w. Sonora. Pubescence of the leaves variable, but when copious usually loose, pilosulous or tomentulose, silvery only in the vicinity of San Bernardino Mountains. 4. *Ps. arborescens.*
   2. Pod glabrous (except for ciliolate keels), the faces charged with very numerous small, orange glands confluent lengthwise (especially toward the beak) into irregular crowded ridges, the whole surface of the fruit glandular-pustulate; dorsal and lateral *calyx-teeth* spreading or reflexed in age; extreme e. Colorado and Mohave deserts in e. San Bernardino and e. Riverside counties, California, e. through n. Arizona and s. Nevada (s. Nye and Clark counties) to the Virgin and Esclante rivers in s.-w. and s.-centr. Utah. Pubescence of the leaves usually copious and subappressed, the foliage normally silvery-canescent. 5. *Ps. fremontii.*

3. Psorothamnus schottii (Torrey) Barneby
(Plate IV)

Divaricately branching, spinescent shrubs of irregular or of rounded, bushy outline, up to 1–2.5 m tall and up to 2 m diam, the old wood becoming stramineous or whitish, furrowed or flakey, the shorter lateral branchlets becoming lignified and thorny, the

branchlets of current year commonly green or golden-green, glabrous or sparsely strigulose, more rarely silky-canescent, the hairs narrowly ascending to subappressed and up to 0.2–0.35 mm long, the foliage cinereous or silvery, the leaflets usually densely pubescent above and greenish to truly glabrous beneath, sometimes silvery both sides; *leaf-spurs* very short or obscure, up to 0.5 mm long; *stipules* triangular, 0.2-0.4 mm long, yellowish, early deciduous; *intra-* and *post-petiolular* glands 0; *leaves* both solitary at nodes of new growth and fasciculate on inhibited short-shoots, (0.6) 1–2.8 cm long, either all reduced to a linear petiolulate leaflet or some of them 3-foliolate, the lateral pair also linear, decurrent into the rachis, the blades of all plane above, with thickened, revolute, commonly gland-undulate margins, the midrib prominent beneath; *racemes* terminal to sub-pliant lateral branchlets, sessile or nearly so, loosely (3) 5–20-flowered, the flowers spreading-ascending, the stiff but not spinescent axis 1–9 cm long; *bracts* triangular-subulate, 0.5–1.3 mm long, gland-toothed on either margin, caducous; *bracteoles* subulate, like the bracts in texture, caducous, only 0.3–0.9 mm long; *calyx* (4) 4.6–5.7 (6.5) mm long, either glabrous externally up to the minutely puberulent (internally always densely pilosulous) teeth or variably strigulose throughout, the obconic hypanthium (1.2) 1.5–2.4 mm deep, the tube (2.8) 3.3–4.3 (4.6) mm long measured to a lateral sinus, the deltate to broadly ovate-deltate or -triangular teeth unequal, the ventral pair much the broadest and usually by a little the longest, 1–1.7 (2) mm long, 1.7–2.2 mm wide, united behind the banner into a shallow sinus, the intervals between the ribs firm, the broad ventral ones charged with ± 1–17 glands in 2 irregular rows, the narrower ones with ± 1–5 glands in 1 row, the glands variable in size and color, pallid to brown or purplish, sometimes concealed by vesture; *petals* deep vivid blue except for a yellowish eye in the banner, all glandless; *banner* cuneate-flabellate, (6.4) 7.1–10.5 mm long, the claw with membranous involute margins, the blade deeply retuse, angled at base; *wings* usually a trifle longer than banner, (7) 7.6–10.2 mm long, the claw 2.2–3.3 mm, the broadly oblong obtuse or emarginate blade (6) 7–8.6 mm long, 3–4.2 mm wide; *keel* a trifle longer or shorter than wings, the claws 2.4–3.6 mm, the blades (6.1) 6.5–8 (8.8) mm long, 3.7–4.7 mm wide; *androecium* 7–11 mm long, the filaments free for 3.5–6.5 mm (± half their length), the pallid anthers 0.9–1.3 mm long; *pod* obovoid-cuneate, 7–10 mm long, 3.6–5.2 mm diam, subcompressed laterally, not carinate along prow, puberulent distally but otherwise glabrous, the valves charged with large discrete glands; *seed* castaneous or livid-castaneous, smooth, 6–8 mm long, 3.3–4 mm diam; $2n = 10_{II}$ (Raven, Kyhos & Hill, 1965). — Collections: 52 (v.v.).

Gravelly benches of low desert mountains, descending over outwash fans and along bouldery or sandy washes to the valley floor, there sometimes arresting drift-sand into hummocked dunes, 5–450 (750) m (mostly below 1500 ft), common and locally abundant around the n. and w. margins of the Colorado Desert, California, from Coachella Valley e. to the Eagle and Chuckwalla mountains, s. through e. San Diego and adjoining Imperial counties into n.-e. Baja California (Edo), there following the e. foothills of Sierras Juárez and San Pedro Mártir and the adjoining coastal plain as far s. as Ensenada de San Francisquito (near 29° 40′ N); apparently somewhat rarer and isolated in s.-e. Colorado and Yuma deserts in Imperial County, California to e. of Salton Sea (Cargo Muchacho Mts), and vicinity of Yuma, Arizona; to be looked for in extreme n.-w. corner of Sonora. — Flowering November to May, in California most abdundantly in mid-February to April. — *Representative*: UNITED STATES. CALIFORNIA. Riverside: *C. L. Hitchcock 5849* (NY, UC); *Hall 5781, 5973* (UC); *Parish 4113* (NY). San Diego: *Eastwood 2689* (CAS, NY); *Jepson 8819, 8950, 12,465* (UC-JEPS); *Gander 3137, 4723, 7107* (SD). Imperial: *Ferris 7171* (NY), *7731* (NY); *Crampton 6460* (UC). ARIZONA. Yuma: *Lemmon in 1881* (UC). MEXICO. BAJA CALIFORNIA (Edo): *Moran 7546* (SD), *9850* (SD), *10,344* (SD, UC); *Hastings & Turner 63-159* (ARIZ).

Psorothamnus schottii (Torrey) Barneby, comb. nov., based on *Dalea schottii* (Arthur Carl Victor Schott, 1814–1875, naturalist with Mexican Boundary Survey) Torr., Bot. Mex. Bound. Surv. 53. 1859 ("*Schottii*"). — "Diluvial banks of the Colorado, February, *Schott*...." — Holotypus, *Schott No. 15, 5,* collected Feb 1855 = *Mex. Bound. Surv. 239*, NY (herb. Torr.)! isotypus, GH! — *Parosela schottii* (Torr.) A. Hell., Cat. N. Amer. Pl. ed 2, 6. 1900. *Psorodendron schottii* (Torr.) Rydb., N. Amer. Fl. **24**: 44. 1919.

Parosela schottii var. *puberula* Parish, Bot. Gaz. **55**: 312. 1913. — "Colorado Desert, April 1905, BRANDEGEE; Borregos Spring, April 29, 1904, BRANDEGEE; Cajon de Santa Maria, Lower California, May 10, 1889, BRANDEGEE." — Holotypus, the first cited, UC! paratypi, as cited, UC! the last (with glabrous calyx) also F! — *Psorodendron puberulum* (Parish) Rydb., N. Amer. Fl. **24**: 45. 1919. *Parosela puberula* (Parish) Standl., Contrib. U. S. Nat. Herb. **23**: 452. 1922. *Dalea schottii* var. *puberula* (Parish) Munz, Man. S. Calif. 598. 1935.

A stiffly and intricately branched, sparsely leafy shrub, called Indigo Bush because of the ornamental multitude of vivid blue, pale-eyed pea-flowers that emerge, in late winter and spring, in loose racemes from the tips of all the branchlets. Nearly everywhere the young stems are green and glabrous, and the calyx-tube is hairless externally. Through the lowlands of Anza-Borrego State Park in San Diego and immediately adjoining Imperial counties a common variant is so-called *Psorodendron puberulum*, differing in its externally strigulose calyx-tube and often pubescent young stems. Even in its region of occurrence this variant fails to replace the typical form, which reappears to the exclusion of the other in the foothills south of the border. The puberulent variant has been indicated from Baja California, but incorrectly; even the collection mentioned by Parish in the protologue of *D. schottii* var. *puberula* actually represents the typical form.

The range of *Ps. schottii* lies within that of the Smoke Tree, *Ps. spinosus*. They sometimes occur together in washes, but the Indigo Bush is more abundant on benches and rocky slopes above the level of torrent waters. The Smoke Tree flowers a month or more after the last flowers of *Ps. schottii* have shed their petals. At its northern limit in upper Coachella Valley, *Ps. schottii* narrowly overlaps the closely related *Ps. arborescens* var. *simplifolius*; sometimes, notably around Palm Springs, the two species share a common habitat, although var. *simplifolius* is more abundant and typically developed at a slightly higher level in the foothills. The var. *simplifolius* forms a smaller bush, has a calyx silvery-pubescent from base upward, and may be recognized by its distinctive even though highly polymorphic foliage, the leaves normally pinnate but when reduced to trefoils or simple phyllodia the blades much shorter than in *Ps. schottii* and elliptic not exactly linear.

4. PSOROTHAMNUS ARBORESCENS (Torrey) Barneby

Stiffly irregularly branching, often thorny shrubs up to 3–10 dm tall, variably pubescent to almost glabrous, the foliage gray-tomentulose, silky-canescent, thinly pilosulous, or green and glabrate, the branchlets at nodes immediately preceding the terminal peduncles usually persistent as rigid lignified spines, the young parts (especially the raceme-axis) charged with subulate or prickle-shaped glands, the leaflets gland-pustulate beneath (the glands sometimes concealed by vesture); *leaf-spurs* up to 1 mm long; *stipules* narrowly subulate to linear-attenuate, 0.7–2 mm long, soon papery, brownish, fragile; *intrapetiolular glands* 0; *post-petiolular glands* 0 or minute; *leaves* (1) 1.3–3.5 (5.5) cm long, petiolate, with ± margined rachis and (3) 5–7, rarely up to 17 leaflets variable in outline according to varietas from ovate or lanceolate to linear, the terminal one often continuous with the rachis, the last pair often confluent, sometimes all decurrent on rachis, sometimes all sessile but jointed, the leaf rarely reduced to a simple blade; *raceme* sessile or subsessile (the lowest bracts sometimes foliose, or a branchlet intervening between the lowest and succeeding flowers), loosely but sometimes shortly 8–40-flowered, the flowers spreading-ascending, the axis (1) 1.5–12 cm long, becoming stiff and persisting after fall of the pods; *bracts* papery, narrowly subulate or linear, 2.5–4 mm long, deciduous; *bracteoles* similar but shorter, 1–2 mm long;

calyx 5–9 mm long, externally glabrous to variably pubescent, the hypanthium 1.5–3 mm deep, the tube (measured to a lateral sinus) 3–4.5 mm long, the ribs becoming bluntly prominent, the firm intervals charged with small brownish glands, the 2 broad ventral intervals with ± 2 rows, the rest with 1 row of ± 3–5 glands, the teeth dissimilar, the ventral pair broadly lanceolate to triangular short-acuminate, 2–4.5 mm long (1 mm shorter to 0.5 mm longer than tube), (1.2) 1.4–2 mm wide near base, the rest lanceolate, ± half as wide, the dorsal one often shortest, the sinus behind the banner commonly much shallower than the rest; *petals* indigo-blue or violet-purple, glandless, deciduous; *banner* 6.3–10.5 mm long, its claw very short, its blade flabellate or flabellate-obovate, deeply retuse, at base either cuneately tapering or subauriculate; *wings* a trifle longer than banner, the claw 2.2–3.6 mm long, the broadly oblong or oblong-obovate, obtuse or subemarginate blade 5.4–8.2 mm long, 2.2–3.5 mm wide; *keel* usually a trifle longer than wings, rarely a little shorter, 8.2–11.2 mm long, the claws 2.6–3.7 mm, the obliquely obovate blades 5.9–8.2 mm long, 3.3–4.9 mm wide; *androecium* (5.5) 6.5–9.8 mm long, the filaments free through (3) 3.5–5.6 mm, the anthers (0.85) 0.9–1.3 mm long; *pod* obliquely ellipsoid or ovoid-ellipsoid, the subcompressed body 8–10 mm long, (3.6) 4–6 mm diam, at least beyond the middle 2-carinate by the sutures, the convex valves charged with large, round or broadly elliptic blister-glands, between the glands either villosulous or glabrous, the ventral suture ciliolate; *seed* (4.7) 5–6 mm long.

These are small shrubs, never arborescent as suggested by the inappropriate epithet, and diverse in aspect because so variable in pubescence, in configuration of the leaves, and in flower-size. The species differs as a whole from the closely related *Ps. schottii* in its smaller stature and usually pinnate (not simple or trifoliolate) leaves, always excepting the anomalous *Ps. arborescens* var. *simplifolius*, discussed in more detail below and in relation to *Ps. schottii* itself.

Over a great part of the Mohave Desert in California and west-central Nevada *Ps. arborescens* is the only member of sect. *Xylodalea* and with the exception of *Ps. polydenius* the only *Psorothamnus*, and like the latter is found chiefly, perhaps exclusively, on granitic and volcanic bedrock. On the calcareous ranges of far southeastern Mohave it is replaced by the vicariant and perhaps too closely related *Ps. fremontii*, distinguishable by no feature of moment up to the distinctive pod. The pods of all forms of *Ps. arborescens* are like those of *Ps. schottii* charged with relatively few, large, circular blister-glands scattered over an eglandular field in polka-dot patterns. In *D. fremontii* the pod valves are covered by small orange glands of indeterminate size and shape which run together into irregular lines or ridges, the surface appearance being that of caramelized sugar.

Beyond the limits of the Mohavean floristic province *Ps. arborescens* is represented by two distantly isolated populations, one relatively extensive in the valley of Colorado River upstream from Grand Canyon in northern Arizona, the other dramatically disjunct on the Sonoran shore of Gulf of California, where it has been collected in only one station. The latter, surprisingly, cannot be distinguished at present from typical *Ps. arborescens* of southwestern Mohave Desert. The Arizona plant appears below as *Ps. arborescens* var. *pubescens*.

Key to the Varieties of *Psorothamnus arborescens*

1. Calyx 7–9 mm long, the tube 3.6–4.5 mm, the ventral pair of teeth 3–5.4 mm long; relatively local in three disjunct areas: s.-w. Mohave Desert in w. San Bernardino and adjoining Kern counties, California; n.-w. Sonora; n.-centr. Arizona.

2. Leaflets (3) 5–7, mostly rhombic-ovate to broadly lanceolate, often partly confluent with the rachis, the widest on the individual plant well over 2.5 mm wide; foliage either villous-tomentulose or glabrate; Mohave Desert and Sonora. 4a. var. *arborescens*.

2. Leaflets (5) 7–11, linear or narrowly oblanceolate, none over 1.5 mm wide; foliage silky-strigulose; n.-centr. Arizona. 4d. var. *pubescens*.

1. Calyx 5–6.8 mm long, the tube 3–4.2 mm, the teeth 1.8–3.7 mm long; n. Colorado to n. Mohave Desert, Owens and Death valleys, and Mineral County, Nevada, local in Coachella and San Jacinto valleys and vicinity, Riverside and s. San Bernardino counties, California.

3. Calyx-tube glabrate or only minutely puberulent; leaflets loosely pubescent to glabrous, of an ovate or lanceolate type, mostly acute, some at least 2.5 mm wide; n. Kern, Inyo, Mono counties, California, and adjacent Nevada. 4b. var. *minutifolius*.

3. Calyx-tube silky-canescent; leaflets of linear-oblanceolate type, mostly less than 2 mm wide, all usually silky-strigulose and decurrent into the rachis; Cochella and San Jacinto valleys about s. foothills of San Bernardino Mountains and vicinity. 4c. var. *simplifolius*.

4a. PSOROTHAMNUS ARBORESCENS (Torrey) Barneby var. ARBORESCENS
(Plate IV)

Variable in pubescence, the foliage either densely villous-tomentulose or only thinly pilosulous, gray or green; young *branchlets* usually purplish, the old becoming brown and furrowed; *leaves* 1–3.5 cm long, the (3) 4–7 leaflets ovate to obovate or elliptic, often asymmetrically so, obtuse, emarginate, or bluntly gland-mucronulate, (3) 5–10 mm long, the 3 uppermost of all leaves usually decurrent and often irregularly confluent, but sometimes all free and the lateral ones all jointed; *flower* large, the calyx as given in key; *petals* indigo blue, the banner 9–10 mm, the keel 10.2–11.4 mm, its blades 8.2–8.4 mm long; *pod* either glabrous except for a few hairs along the ventral keel or thinly villosulous; *androecium* mostly 8.8–9.8 mm long, the filaments free for 4–5.6 mm. — Collections: 22 (i).

Desert hillsides and stony flats in the Larrea belt, on granitic bedrock, sometimes with *Yucca arborescens*, 390–780 m (1300–2600 ft), locally plentiful in scattered stations on s.-w. Mohave Desert in w. San Bernardino and adjoining Kern counties, California (approximately within the triangle formed by towns of Victorville, Barstow, and Randsburg); greatly isolated near sea-level on shore of Gulf of California in n.-w. Sonora (Puerto Peñasco, lat. ± 30° 40′N). — Flowering April and May. — *Representative*: UNITED STATES. CALIFORNIA. San Bernardino: *Wolf 3418, 3419* (SD); *Hall 6160* (NY, UC), *6197* (UC); *L. S. Rose 12,055, 12,058* (CAS, NY); *Hall & Chandler 6851* (UC); *Ripley & Barneby 5206* (NY). MEXICO. SONORA: *L. H. Cook in 1934* (SD).

Psorothamnus arborescens (Torr.) Barneby, comb. nov., based on *Dalea arborescens* (becoming treelike, a misnomer, taken from Fremont's label) Torr. ex Gray, Mem. Amer. Acad. II, **5**: 316. 1854. — "Mountains of San Fernando, a southern branch of the Sierra Nevada, California; April, *Fremont*." — Holotypus, dated April 14, 1844, NY (herb. Torr.)! isotypus, GH! — *Parosela arborescens* (Torr.) A. Hell., Cat. N. Amer. Pl. ed 2, 5. 1900. *Psorodendron arborescens* (Torr.) Rydb., N. Amer. Fl. **24**: 42. 1919.

Dalea saundersii (Charles Francis Saunders, 1859–1941) Parish, Bull. S. Calif. Acad. Sci. **2**: 83, Pl. 2. 1903 ("*Saundersii*"). — "...near Victorville, cir. 3000 ft. alt., on the Mojave Desert, May 12–14, 1903, by Mr. C. F. Saunders." — Holotypus, DS (hb. Parish.)! isotypus, GH! — *Parosela saundersii* (Parish) Abrams, Bull. N. Y. Bot. Gard. **6**: 396. 1910. *P. johnsoni* var. *saundersii* (Parish) Parish, Bot. Gaz. **55**: 308. 1913. *Psorodendron saundersii* (Parish) Rydb., N. Amer. Fl. **24**: 44. 1919. *Parosela fremontii* var. *saundersii* (Parish) Macbr., Contrib. Gray Herb., New Ser. **65**: 16. 1922. *Dalea fremontii* var. *saundersii* (Parish) Munz, Man. S. Calif. 598. 1935.

Parosela neglecta (overlooked) Parish, Bot. Gaz. **55**: 306. 1913. — "Fishpond Station (Daggett), May 1882, PARISH 644, type...." — Holotypus, DS (hb. Parish.)!

On stony flats and outwash fans in the desert foothills at several known localities to the north, northwest, east and southeast of Barstow there are two superficially dissimilar, large-flowered *Psorothamnus*, one villous-tomentulose throughout with long soft gray hairs, the other with green, thinly pubescent or glabrous foliage and an externally glabrous calyx. The two gatherings each of Hall, Rose, and Wolf cited above as representative of var. *arborescens* were chosen so as to demonstrate one of each sort, which apart from vesture are essentially identical and can only be interpreted as minor variants. The types of *D. arborescens* and *P. neglecta* represent the villous phase, that of *P. saundersii* the glabrate one. Nothing definite is known about the type-locality of *D. arborescens*, except that it cannot be San Fernando, as given in the protologue. The holotypus is dated April 14, 1844. On this date Fremont (Rep. Explor. Exped. 256. 1845) crossed Oak Creek Pass in the Tehachapi Mountains and descended at least to the first groves of Joshua Tree (*Yucca arborescens*) at the desert edge somewhere southwest of the present town of Mojave in Kern County. The species has not been seen subsequently in this region and is not listed in Twisselmann's county flora. Fremont's entry for April 25, 1844, when his party was travelling east across the desert somewhere east of Barstow on the Mojave River, contains a reference to "a handsome leguminous shrub, three or four feet high, with fine bright-purple flowers...a new psoralea...." It seems likely that this marks the discovery of *Ps. arborescens*, which Jepson (1936, p. 332) also traces to Barstow. On the Mohave Desert var. *arborescens* occupies an area with a long diameter of about 60 miles, extending from a point 20 miles n.-e. of Barstow to near Cajon Pass, and north to Randsburg, where K. Brandegee in 1913 collected both glabrate and subvillous individuals (NY); these plants are somewhat transitional to the smaller-flowered var. *minutifolia*. The one collection from the head of the Gulf of California, at a point 480 km (± 300 miles) distant to the southwest, appears identical with the villous Mohavean type.

4b. PSOROTHAMNUS ARBORESCENS (Torrey) Barneby MINUTIFOLIUS (Parish) Barneby

(Plate IV)

Habitally like var. *arborescens*, but more commonly glabrescent or glabrate, nevertheless sometimes densely gray-villosulous; old *branches* ashen or stramineous, usually much contorted and ligneous; *hairs* on leaf and calyx up to (0.2) 0.3–0.5 mm long, the foliage varying from bright yellowish-green to canescent; *leaves* up to 3.5 (5.5) cm long, the leaflets lanceolate to rhombic-ovate or -elliptic, obtuse or subacute, 3–13 (17) mm long; *flower* a little smaller than that of var. *arborescens*, the calyx as given in key; *petals* either indigo blue or violet, the banner 7.6–9 mm, its claw 1.8–2.2 mm, its blade 6.4–7.2 mm long, 4–7.4 mm wide; *keel* 8.4–10.3 mm long, its blades 6.3–8.2 mm long, 3.5–4.8 mm wide; *pod* as in var. *arborescens*, but the valves apparently always glabrous; n = 20 (Raven, Kyhos & Hill, 1965, sub *D. fremontii minutifolia*); 2n = 10_{II} (Raven et al., 1965, sub *D. fremontii fremontii*). — Collections: 54 (v.v.).

Rocky and sandy desert hillsides, canyon-benches, sometimes on talus under cliffs, 150–1890 m (500–6300 ft), locally common through w.-centr. and n. Mohave Desert, California, from n.-e. Kern County (Rand and El Paso mountains) n. to s. Mono County (lower Owens Valley and near Benton), e. to w.-centr. San Bernardino County (Ord and Calico mountains, where overlapping and confluent with var. *arborescens*) and in Inyo County to Death Valley, thence extending across the Last Chance and Funeral ranges into the s. point of Esmeralda and extreme s. Nye County, Nevada. — Flowering April to June. — *Representative*: CALIFORNIA. Mono: *Shockley 425* (UC); *J. Reveal 388* (NY). Inyo: *Duran 2625* (NY, OKLA); *Templeton & Clokey 5727* (NY, UC, WIS); *Wolf 6680* (NY, POM, UC); *C. L. Hitchcock 6194* (NY, UC); *L. S. Rose 58,106* (CAS, OKLA, UC). Kern: *Twisselmann 8144, 10,727, 15,333* (NY). San Bernardino: *I. Johnston 6521* (UC); *Lemmon 3132* (UC); *Jepson 6697* (UC-JEPS); *Hall & Chandler 6826* (UC). NEVADA. Esmeralda: *Maguire & Holmgren 25,272* (NY, UC). Nye: *Maguire & Holmgren 25,179* (UC).

Psorothamnus arborescens var. **minutifolius** (Parish) Barneby, comb. nov., based on *Parosela johnsoni* var. *minutifolia* (tiny-leaved) Parish, Bot. Gaz. **55**: 308. 1913. — "Mouth Panamint Canon [Inyo Co., Cal.] May 11, 1906, HALL and CHANDLER 7002; Providence Mountains [San Bernardino Co.] May 24, 1905, BRANDEGEE." — Lectotypus, *Hall & Chandler 7002*, but dated May 14, UC! The Brandegee paratypus not located, but e. loc. = *Ps. fremontii*. — *Dalea fremontii* var. *minutifolia* (Parish) L. Benson, Bull. Univ. Ariz. **15**(2): 364. 1945, quoad nom.

Parosela wheeleri (George Montague Wheeler, 1842–) Vail, Bull. Torrey Club **24**: 17. 1897 ("*Wheeleri*"). — "...Nevada, Wheeler expedition, 1872...." — Holotypus, collected in 1872 by Ferdinand Bischof, NY (fragm.)! isotypi, GH, US (attributed to *Wheeler*)! — *Psorodendron wheeleri* (Vail) Rydb., N. Amer. Fl. **24**: 42. 1919. *Parosela fremontii* var. *wheeleri* (Vail) B. L. Robins. ex Macbr., Contrib. Gray Herb., New Ser. **65**: 16. 1922. *Dalea arborescens* var. *wheeleri* (Vail) Tidest. in Tidest. & Kitt., Fl. Ariz. & New Mex. 179. 1941.

As here circumscribed, var. *minutifolius* differs from var. *arborescens* in no respect other than the smaller flower and even in these terms cannot be separated by any known discontinuity. It is a somewhat artificial segregate, although from the biological point of view it is the local, large-flowered var. *arborescens* which seems to be the derived form. On the Mohave Desert in the Barstow region populations of var. *minutifolius* and var. *arborescens* exist very nearly in contact with each other, the former apparently in more rocky sites in the foothill canyons (Ord and Calico mountains), the latter out on the open desert. In western, central and northern Mohave Desert, Owens Valley, and the Death Valley region, where it becomes especially abundant, var. *minutifolius* is the only member of sect. *Xylodalea* recorded. It varies like var. *arborescens* in pubescence, and considerably more so in amplitude of the leaflets, but a densely villosulous phase comparable to the typus of *Ps. arborescens* is rare.

The substance of var. *minutifolius* has been treated in the literature under a variety of synonyms but has always been separated (except for the villous phase of it) from *Ps. arborescens* at the specific level. Most students of the group have subordinated it to *Ps. fremontii*, sometimes recognizing different leaf- and pubescence-forms as coordinate varieties, although these have never been correlated with respectable geographic patterns of dispersal. It is construed in these pages as specifically distinct from *Ps. fremontii* without any attempt to deny the manifestly close relationship between them. Whatever the status of the two taxa may be, they are allopatric and sharply characterized by the pods. Genuine *Ps. fremontii* occurs in California only on the sedimentary ranges of far eastern Mohave Desert, whereas var. *minutifolius* has been reported only from granitic and volcanic bedrock. A relatively small area lying to east of the San Bernardino Mountains equidistant more or less between var. *minutifolius* and var. *arborescens* to the north, var. *simplifolius* to the west, and *Ps. fremontii* to the east, is occupied by populations of *Psorothamnus* that are transitional between the first two mentioned, and sometimes mimic *Ps. fremontii* in their silvery-strigulose vesture. These are referred to *Ps. arborescens* sens. lat. because of the

gland-dotted pods but can only be assigned arbitrarily to either var. *minutifolius* or var. *simplifolius* (Cottonwood and Sheephole ranges: *Jepson 5982*, UC-JEPS; *Hall 6024, 6057*, UC; *Ferris & Bacigalupi 8129*, UC).

It should be noted that the epithet *minutifolius* has been transferred in the literature from the *Psorothamnus* common in the canyons of the Panamint Mountains to the form of *Ps. fremontii* with linear leaflets described below as var. *attenuatus*.

4c. Psorothamnus arborescens (Torrey) Barneby var. simplifolius (Parish) Barneby

(Plate IV)

Habit nearly of 2 preceding, but canescently silky throughout with subappressed and ascending hairs up to 0.2–0.35 mm long, the lower leaves sometimes green and glabrescent; *leaves* 3–35 mm long, the leaflets mostly 5 or 7, seldom 3 or 9, oblanceolate to narrowly elliptic, 2–12 mm long, all decurrent on the rachis or some (exceptionally almost all) leaves reduced to a bractlike simple blade less than 1 cm long; *racemes* 3–15 cm long; *calyx* densely silky-strigulose externally, 5.2–6.9 mm long, the hypanthium 1.8–2.2 mm deep, the tube 3.2–4.2 mm, the ventral pair of teeth 1.9–3.7 mm long (1.9 mm shorter to 0.5 mm longer than tube) and 1.5–2.1 mm wide; *petals* indigo-blue; *banner* 6.3–7.8 mm, its claw 1–1.5 mm, its blade 5.4–6.3 mm long, 5.2–5.8 mm wide; *keel* 8.5–8.8 mm long, the claws 2.8 mm, the blades 5.8–6.4 mm long, 3.3–3.9 mm wide; *pod* (6) 7–9 mm long, 4–5 mm diam, the valves subglabrous; $2n = 10_{II}$ (Raven, Kyhos & Hill, 1965). — Collections: 29 (v.v.).

Rocky benches and bouldery washes, coming out on stony flats with *Larrea* to the edge of the desert floor, 135–1050 m (450–3500 ft), locally plentiful along the s. and s.-e. foothills of San Bernardino Mountains in Riverside and extreme s. San Bernardino counties, California, from Whitewater Pass through upper Coachella Valley to the Little San Bernardino Mountains, n.-e. through Morongo Pass, thence passing into var. *minutifolius*; from Whitewater extending s.-w. feebly into San Jacinto Valley w. of the desert proper. — Flowering December to May (June). — *Representative*: California. San Bernardino: *Parish 2991* (NY, UC), *2992* (NY); *Alexander & Kellogg 2268* (NY). Riverside: *Wolf 3680* (UC); *L. S. Rose 11,997* (CAS, NY); *Hall 2008* (NY); *Vasey 134* (NY).

Psorothamnus arborescens var. **simplifolius** (Parish) Barneby, comb. nov., based on *Parosela californica* var. *simplifolia* (entire-leaved) Parish, Bot. Gaz. **55**: 309. 1913. — "Western part of the Colorado Desert, M. F. Gilman, *51*...." — Holotypus, collected in 1904, UC! — *Dalea fremontii* var. *simplifolia* (Parish) L. Benson, Amer. Jour. Bot. **30**: 239. 1943.

Dalea californica (of California) Wats., Proc. Amer. Acad. **11**: 132. 1876 ("*Californica*"). — "Known as yet only from scanty specimens recently collected by Dr. Parry in the San Bernardino Mountains [more precisely, as Parry told Parish (Bot. Gaz. **55**: 309), 'east of Banning, on the borders of the Colorado Desert'], California." — Holotypus, *Parry s. n. in 1876*, GH! — *Parosela californica* (Wats.) Vail, Bull. Torrey Club **24**: 17. 1897. *Psorodendron californicum* (Wats.) Rydb., N. Amer. Fl. **24**: 43. 1919.

The var. *simplifolius*, easily recognized in Coachella Valley by its silvery pubescence and leaves mostly pinnate but with decurrent leaflets, might be visualized as combining the foliage of *Ps. fremontii* with the spotted pod of *Ps. arborescens*. It has been evaluated repeatedly as an independent species but, as noted under the preceding, forms transitional in their greener, broader leaflets to var. *minutifolius* are encountered along the zone of floristic transition between the

Mohave and Colorado deserts. The resemblance between var. *simplifolius* (or *Dalea californica*) and *Ps. fremontii* has been noted often and has been an obstacle from early times to the separation of *D. arborescens* and *D. fremontii* on a sound basis. The keys to the shrubby daleas presented by McMinn (1939, p. 219) and Benson (in Benson & Darrow, 1954, p. 207) assign decurrent leaflets to *arborescens* and jointed ones to *fremontii*; but both authors procede to a variety of the latter on the character of decurrent leaflets. Without the character of the pod brought out in this account there could be no logical alternative to reduction of all *Xylodalea* (or all, perhaps, but *Ps. schottii*) to one species, composed it is true of several geographic races, but these as confluent as the leaflets themselves.

The quaintly formed epithet *simplifolius* is descriptive only of the relatively uncommon minor variant in which most, sometimes all leaves are reduced to a small phyllode or a depauperate trefoil. The holotypus of var. *simplifolia* is an indifferent unicate misleadingly described in the protologue as glabrous throughout. Specimens from Palm Springs, a locality from which there is abundant material for study, demonstrate all gradations between a plant with nothing but phyllodia (*L. S. Rose 38,322,* CAS, NY, OKLA, UC), with mixed phyllodia and pinnae (*Jones in 1925,* NY, UC), and with none but normally pinnate leaves. Californian botanists long ago realized that these represent taxonomically insignificant variants of a xerophytic nature, but have not applied the lesson so learned to other races of *Psorothamnus*. A provocative aspect of the simple-leaved variant is its occurrence in the common range of *Ps. arborescens* sens. lat. and *Ps. schottii*, in which simple and trifoliolate leaves, even though their divisions are relatively narrower and always longer, are characteristic. The plastic nature of the leaf in var. *simplifolius* is of a type that might be expected following introgression between sympatric relatives. The pods of all are so much alike that no corroboration of hybridity can be derived from that quarter.

4d. Psorothamnus arborescens (Torrey) Barneby var. pubescens (Parish) Barneby

(Plate IV)

Habitally similar to var. *arborescens*, up to 6–8 dm tall, the young branches often purplish, becoming furrowed lengthwise, the foliage loosely strigulose or pilosulous with subappressed or weakly ascending hairs up to 0.2–0.5 mm long, either green or ashen, the calyx usually pilosulous with widely divergent hairs up to 0.5–1 mm long, sometimes loosely strigulose with hairs less than 0.35 mm long; *leaves* 1.5–3.5 cm long, the leaflets (5) 7–11, linear to linear-oblanceolate, 3–14 mm long, 0.4–1.4 mm wide, the upper 1–3 commonly decurrent, the rest usually jointed but rarely petiolulate; *racemes* ± 2.5–5 cm long; *calyx* 7.3–9 mm long, the hypanthium 1.4–2 mm deep, the tube 3.6–4.4 mm long, its orifice symmetrical (all sinuses ± equally deep), the lanceolate teeth subequal in length, 3.5–5.4 mm long, the ventral pair ± twice as wide as the dorsal one, at base 1.2–1.6 mm wide; *petals* indigo-blue; *banner* ± 7 mm long, the claw 2 mm, the blade 5–5.2 mm long, 4.4–5.4 mm wide; *keel* 8.2–9.1 mm long, the claws 3.1–3.7 mm, the blades 6–6.4 mm long, 2.7–3.7 mm wide; *pod* pilosulous on the sides, usually densely so. — Collections: 8 (i).

Rocky clay knolls and talus under cliffs, on sandstone, 1035–1470 m (3450–4900 ft), rare and local around the e. end of House Rock Valley of the Colorado River in Coconino County, Arizona, from Lee's Ferry (or Navajo Bridge) to points 5 miles s. and 17 miles w., to be sought on benches leading down into Grand Canyon. — Flowering late April to June. — *Material*: Arizona. Coconino: *S. B. Benson 137* (UC); *Peebles & Parker 14,648, 14657* (NY, US); *Barkley & Reed 4360* (NY); *Ripley & Barneby 4912* (CAS, NY); *Bishop* ("Utah, 1872," fragm., perhaps = isotypus of *D. amoena*, NY).

Psorothamnus arborescens var. **pubescens** (loosely hairy compared with *Ps. johnsoni*) Parish, Bot. Gaz. **55**: 308. 1913. — "Lee's Ferry, Arizona, June 13, 1890, JONES 3076." — Holotypus, DS (hb. Parish.)! isotypi, UC, US! — *Psorodendron pubescens* (Parish) Rydb., N. Amer. Fl. **24**: 44. 1919. *Dalea fremontii* var. *pubescens* (Parish) L. Benson, Amer. Jour. Bot. **30**: 239. 1943. *D. amoena* var. *pubescens* (Parish) Peebles, Jour. Wash. Acad. **30**: 473. 1940.

Dalea amoena (agreable) Wats., Amer. Nat. **7**: 300. 1873. — "Northern Arizona (Mrs. E. P. Thompson). In damp places; April." — Holotypus, labelled 'Kanab, 1872', GH! isotypi (fragm.), NY, US! — *Parosela amoena* (Wats.) Vail, Bull. Torrey Club **24**: 17. 1897. *Psorodendron amoenum* (Wats.) Rydb., N. Amer. Fl. **24**: 44. 1919. *Dalea fremontii* var. *amoena* (Wats.) Tidest. in Tidest. & Kitt. Fl. Ariz. & New Mex. 180. 1941, comb. illegit.

A distinguished endemic of the Colorado River canyonlands, var. *pubescens* is a truly rare plant, with a known range hardly exceeding 25 kilometers in long diameter, this situated at a distance of some 420 kilometers (or 260 miles) east of its near relatives in the Mohave Desert. Even within this restricted range the variety retains some of the variability in pubescence that characterizes its species as a whole, the hairs on the leaves differing from one plant to the next in density and on the calyx in length, with extremes here of 0.3–1 mm. The type-collection of var. *pubescens* represents the phase with relatively long calyx-hairs, and was not recognized by Parish as related to the sympatric *Dalea amoena*. Rydberg maintained these two proposals as a coordinate species of *Psorodendron* supposedly characterized by elongate calyx-teeth of about equal length. However the teeth are not in reality longer than in some specimens of var. *arborescens* and the ventral pair are almost twice as wide as the dorsal tooth. The combination of linear leaflets, a symmetrical orifice to the calyx, and a disjunct dispersal are the genuinely distinctive differential characters.

Nothing exact is known about the type-locality of *D. amoena*. Vail thought it must be Kanab, Utah, where the Powell Grand Canyon Expedition maintained its headquarters in the summer of 1872, but this is probably a mistake. Several other plants (e.g., *Psorothamnus thompsonae, Petalostemon flavescens, Astragalus episcopus* Wats.) supposedly collected near Kanab by Ellen Powell Thompson and Captain E. K. Bishop have not been seen since in that vicinity. Bishop certainly, and possibly Mrs. Thompson also, must have accompanied Powell upstream at least as far as Grand River, Utah, and could well have encountered var. *pubescens* within its range as now known. It seems not unlikely that the fragmentary Bishop collection at NY is really part of the type-collection. It is labelled "Utah", suggesting that var. *pubescens*, at least before construction of Glen Canyon Dam, followed the Colorado northward across the state line.

5. PSOROTHAMNUS FREMONTII (Torrey) Barneby
(Plate IV)

Low straggling or erect, irregularly branching shrubs up to 3–10 dm tall, stiff but hardly thorny (spinose branchlets at nodes preceding the racemes rare or 0), the raceme-axes persistent but not spinose, the often tortuous old stems pallid or whitish, the young twigs and foliage eglandular or almost so, strigulose with appressed or narrowly ascending white hairs up to 0.2–0.35 (0.4) mm long, the foliage ashen or silvery, the leaflets often more densely pubescent above than beneath, their lower face punctate, the inflorescence-axis charged with prickle-shaped glands; *leaf-spurs* up to 1 mm long; *stipules* subulate or subulate-attenuate, subglandular, brown or livid, 0.7–1.2 mm long; *intrapetiolular glands* 0; *post-petiolular glands* small; *leaves* alternate along young flowering shoots and fascicled on inhibited short-shoots of old wood, all petioled, 1–4 cm long, with 3–7 (9) leaflets varying in outline according to varietas from narrowly obovate to linear, 3–25 mm long, all sessile or nearly so, either all jointed to the rachis, or (especially in leaves low on the branchlets or fascicles) either the terminal one alone or the last 3 (rarely all) decurrent and ± confluent, their thickened margins revolute; *peduncles* 0–1 (2) cm long; *racemes* loosely (5) 10–25 (30)-flowered,

the axis becoming 2–9 (11) cm long; *bracts* papery, brownish, 1.2–2 mm long, early deciduous; *bracteoles* similar but smaller, 0.4–1.7 mm long; *pedicels* 0.6–1.4 mm long; *calyx* (5) 5.4–7.7 mm long, the hypanthium 1.2–1.9 mm deep, the glabrous or strigulose tube (2.8) 3–3.7 (3.9) mm long, the internally silky, lanceolate or triangular-lanceolate teeth unequal, the ventral pair 2.2–3.8 (4.1) mm long, varying from 1.1 mm shorter to 0.6 mm longer than tube, each at base (1.2) 1.4–2.1 mm wide, nearly twice wider than the divergent, ultimately reflexed dorsal tooth, the sinus behind the banner shallower than the lateral ones, the ribs prominent but not cordlike, the firm intervals charged with 1 row of 2–5 (the broader ventral pair with 4–7 scattered) small brown glands; *petals* vivid magenta-purple, glandless, in form like those of *Ps. arborescens*; *banner* 7.3–9.3 mm long, the claw 1.1–2 mm, the blade (6) 6.3–7.4 mm long, (5.2) 5.6–6.8 mm wide; *wings* 7.5–9.9 mm long, the claw 2–3.1 mm, the blade 6.1–7.3 mm long, (2.6) 2.8–3.8 mm wide; *keel* (7.8) 8.2–9.8 mm long, the claws 2.2–3 mm, the blades (6) 6.4–7.5 mm long, (3.6) 4–4.7 mm wide; *androecium* 6.6–9.1 mm long, the filaments free through 3.2–4.4 mm, the pallid anthers (0.7) 0.9–1.2 mm long; *pod* very obliquely ovoid-ellipsoid, subcompressed, the body 7–10 mm long, 4.2–5.3 mm wide, carinate by the nearly straight ventral and strongly convex dorsal sutures, the faces charged with very numerous small orange glands confluent lengthwise (especially distally) into ridges, glabrous except for thinly ciliolate keels; *seed* castaneous, smooth, 4.4–5.8 mm long.

The status of *Ps. fremontii* as a species distinct from *Ps. arborescens* is precarious, contingent on the emphasis laid on gland-patterns of the pod's valves. The neat coincidence of this feature with dispersal is certainly significant of racial differentiation, and it is the rank, not the reality or the definitions that are open to controversial interpretation. A line drawn southward in California from Pahrump Valley astride the Nevada line so as to pass west of the Kingston, Old Dad, Providence, and Whipple mountains, thence turned east to the Colorado River, marks the boundary between *Ps. arborescens* and *Ps. fremontii* on the Mohave Desert. East of that line, from the Needles upstream to lower Lake Mead and up the Virgin River into southwestern Utah, *Ps. fremontii* is the only known *Xylodalea*. Beyond Zion and the Kaibab a complication arises in the shape of outlying populations of *Ps. fremontii* on the Escalante and Colorado rivers in southeastern Utah and extreme northern Arizona, closely approaching but not actually sympatric with the disjunct *Ps. arborescens* var. *pubescens* in House Rock Valley. These taxa are, however, strongly differentiated in ways that do not involve the fruit. At low elevations along and near the Colorado River downstream from lower Lake Mead a poorly differentiated form of *Ps. fremontii* characterized by proportionately long and narrow leaflets has been recognized in recent floristic literature under the names *D. fremontii* var. *johnsoni* or *D. johnsoni* var. *minutifolia*. The epithet *minutifolius*, originally applied to the common *Psorothamnus* of Death Valley, that is to *Ps. arborescens* var. *minutifolius* of the present account, was usurped; the plant is described below, technically for the first time, as *Ps. fremontii* var. *attenuatus*.

Key to the Varieties of *Psorothamnus fremontii*

1. Leaflets narrowly obovate to linear-elliptic, mostly 3–15 mm long, some on a given plant at least 1.5–2 or even 3–4 mm wide; s. Utah, s. Nevada, and e. Mohave Desert in n.-e. San Bernardino County, California, barely entering n.-centr. Arizona in n. Navajo County, and n.-w. Arizona in Mohave County n. of Colorado River, chiefly, perhaps always, on sedimentary formations (limestone, sandstones). 5a. var. *fremontii*.
1. Leaflets all narrowly linear, mostly 5–25 mm long, but the longest not over 1 (1.2) mm wide; far e. Mohave Desert in s.-e. San Bernardino County, California, the southernmost point of Nevada, and Mohave County, Arizona s. of the Colorado River, on granitic and volcanic bedrock. 5b. var. *attenuatus*.

5a. PSOROTHAMNUS FREMONTII (Torrey) Barneby var. FREMONTII

(Plate IV)

Leaflets in outline narrowly ovate-elliptic to narrowly obovate, linear-elliptic, or -lanceolate, (2) 3–15 (20) mm long, the larger ones 1.5–2, seldom 3–4 mm wide; n = ± 20 (Spellenberg). — Collections: 52 (i + v.v.).

Stony flats and benches, terraces in canyons, sometimes on talus, rarely in fine-grained clays about the edge of desert playas, 270–1350 rarely 1600 m (900–5330 ft), locally plentiful in the sedimentary ranges of e. Mohave Desert (Old Dad, Providence, Clark, Kingston, Spring and Charleston mountains) of e. San Bernardino County, California and Clark County, Nevada, in Nevada extending feebly north to margins of Amargosa Desert and Frenchman Basin in s. Nye County, e., always n. of Colorado River, through the valley of the Virgin River and affluents to central Washington County, Utah, Grand Wash in n.-w. Mohave County, Arizona, and Pahranagat Valley in Lincoln County, Nevada; disjunctly in the Colorado Basin on Escalante and Colorado rivers in w. Kane and adjoining San Juan counties, Utah, and extreme n. Coconino and Navajo counties, Arizona. — Flowering April to June. — *Representative*: CALIFORNIA. San Bernardino: *Wolf 6847, 7086, 10,812, 10,851* (NY, UC); *Everett & Balls 23,191* (UC); *Alexander 467* (UC). NEVADA. Nye: *Cronquist & Beatley 8901* (NY); *Beatley 8447* (NY). Clark: *Clokey 5890* (NY, OKLA, UC, WIS, widely distributed), *7988* (NY, UC); *Eastwood & Howell 8930* (CAS, UC); *C. L. Hitchcock 3087* (UC). Lincoln: *Grullion 39* (UC). UTAH. Washington: *Eastwood & Howell 1189* (CAS, NY, UC); *Maguire 12,314* (NY); *Welsh 5272* (NY). Kane: *Ripley & Barneby 13,125* (CAS, NY); *Harrison 12,127* (NY). San Juan: *Welsh 5200* (NY). ARIZONA. Mohave: *Maguire 16,640, 20,596* (NY); *Gould 1805* (NY, UC). Navajo: *J. Wetherill* (from Kayenta) *in 1922* (NY). Coconino: *A., N., P., & D. Holmgren 15,575* (NY).

Psorothamnus fremontii (Torr.) Barneby, comb. nov., based on *Dalea fremontii* (John Charles Fremont, 1813–1890) Torr. ex Gray, Mem. Amer. Acad. II, **5**: 316. 1854 ("*Fremontii*"). — "Mountains of the Pah-Utah country, S. W. California, on rocks; May, Fremont." — Holotypus, collected May 5, 1844, when Fremont's party was encamped on Muddy River in s. Clark County, Nevada, NY (herb. Torr.)! isotypus (fragm.), GH! — *Parosela fremontii* (Torr.) Vail, Bull. Torrey Club **24**: 16. 1897. *Psorodendron fremontii* (Torr.) Rydb., N. Amer. Fl. **24**: 43. 1919.

Dalea johnsoni (Joseph Ellis Johnson, 1817–1882) Wats. in King, Geol. Expl. 40th Parallel, Botany 64. 1871 ("*Johnsoni*"). — "collected by J. E. Johnson near St. George on the Virgin River, Utah, and also in the same locality by Dr. Palmer, 1870." — Holotypus, GH! — *Parosela johnsoni* (Wats.) Vail, Bull. Torrey Club **24**: 17. 1897. *Psorodendron johnsoni* (Wats.) Rydb., N. Amer. Fl. **24**: 43. 1919. *Parosela fremontii* var. *johnsoni* (Wats.) Jeps., Man. Calif. 558. 1925. *Dalea fremontii* var. *johnsoni* (Wats.) Munz, Man. S. Calif. 598, 262, fig. 138. 1935.

An ornamental small shrub with often picturesquely twisted and gnarled branches, silvery-strigulose foliage, and handsome vivid purple flowers. In general appearance it greatly resembles *Ps. arborescens* var. *simplifolius*, but it is easily distinguished by the densely glandular pod, the surface of which appears resinous and wrinkled, not sparsely dotted. The populations of sect. *Xylodalea* found in the Virgin valley near St. George and on the lower Muddy and Meadow Valley rivers in adjoining Clark County, Nevada represent a homogeneous entity, a little variable (as all *Psorothamnus*) in shape and number of leaflets but otherwise uniform, and it seems certain that *Dalea fremontii* and *D. johnsoni*, the types of which came from points about 100 km apart, are exact taxonomic synonyms. In the protologue of *D. johnsoni* Watson admitted that he had only fragments of genuine *D. fremontii* for comparison, and the differences that he seemed to find in the leaves and in the emplacement of the ovules have proved insubstantial. The persistence in the literature of the two epithets, in varying combinations, has been due to

misconceptions of long standing as to the true nature of the plants originally described. Munz (1959, p. 854), largely following Jepson (1936, p. 332), transmuted supposedly typical *D. fremontii* into a silvery phase of *Ps. arborescens* var. *minutifolius* and reserved the name var. *johnsoni* for *Ps. fremontii* sens. lat. of this account, that is including genuine original *fremontii* of the far eastern Mohave Desert along with the vicariant var. *attenuatus*. The plant figured by Abrams (1944, fig. 2767) as *D. fremontii* is ambiguous; according to the accompanying text it should represent *Ps. fremontii* as here treated, but the spotted pod that accompanies it must be (if correctly drawn) some phase of *Ps. arborescens*.

5b. Psorothamnus fremontii (Torrey) Barneby var. attenuatus Barneby (Plate IV)

Leaflets all linear, (3) 5–25 mm long, less than 1 (rarely to 1.2) mm wide; the terminal one often greatly drawn out and longer than the lateral ones, the margins glandundulate. — Collections: 10 (o).

Desert hillsides and rocky canyon slopes, 170–900 m, on granitic and volcanic bedrock, local along and near the lower Colorado River, from vicinity of Parker Dam (Whipple Mts.) in extreme s.-e. San Bernardino County California n. on both the California and Arizona sides into the southern point of Nevada near Davis Dam, thence n.-e. in Mohave County, Arizona to the Grand Wash Cliffs s. of Lake Mead. — Flowering April to June. — *Representative*: California. San Bernardino: *Ferris 7212* (NY); *Wolf 1363, 3187* (POM, SD); *M. Armstrong 47* (NY). Arizona. Mohave: *Lemmon* (Diamond Wash) *in 1884* (UC); *N. C. Wilson* (Sunset Peak) *in 1893* (NY).

Psorothamnus fremontii var. **attenuatus** (narrowed, of the leaflets) Barneby, var. nov., foliolis angustissimis subexacte linearibus vix 1 (rarius 1.2 usque) mm latis, saepe glandulosoundulatis distinguendus caeterum var. *fremontii* omnino similis. — Arizona. Yucca, Mohave County, May 13, 1884, *M. E. Jones 3883*. — Holotypus, NY; isotypi, POM, UC!

The var. *attenuatus* is the *Dalea fremontii* var. *johnsoni* of Kearney & Peebles (1942, p. 456, where expressly distinguished in Arizona from broad-leaved var. *fremontii*), of McMinn (1939, p. 223 in great part, with fig. 250!), and of the standard California floras up to that of Munz & Keck (1959, p. 854), where the concept is unmodified but the name changed to *D. fremontii* var. *minutifolia*. As already mentioned under var. *fremontii* above and under *Ps. arborescens* var. *minutifolius*, neither epithet that has been applied to var. *attenuatus* belongs to it. In California the entity has never been successfully extricated from *Ps. arborescens* var. *simplifolius*, and its range, in order to cover the type locality of var. *minutifolia*, has been stretched to include the Death Valley region.

In the context of sect. *Xylodalea*, where foliage characters are subject to capricious flexibility, var. *attenuatus* is poorly differentiated from var. *fremontii*; as must be expected some individual plants are hard to place in either, especially in the southern point of Nevada and along the southern shore of Lake Mead. Downstream from Needles the variety becomes more strongly and definitely marked, the linear-filiform leaflets becoming almost like those of *Ps. schottii*, but pinnate, of course, not solitary or trefoil.

D. Sectio Psorothamnus

Flowers racemose or spicate, the axis of inflorescence florigerous to apex, becoming spiny (if at all) only after the flowers have fallen; *bracteoles* 0, or represented by sessile glands; *connective* of anthers glandless; *pod* relatively small, its body 2–4.5 mm

long, not or scarcely exserted; *seed* 2–2.7 mm long. — Suffrutescent or fruticose (rarely precociously flowering as herbs), the young stems densely charged with orange blister-glands, often retrorse-pubescent; *leaves* imparipinnate or variously reduced, sometimes to the terminal leaflet; *petals* pink-purple, violet, or blue (white), pubescent or glabrous, deciduous or persistent. — Spp. 4, ammophytes, of maritime and interior deserts in s.-w. United States and n.-w. Mexico, 1 of the Sonoran Desert, 2 of arid basins in the Intermountain region, 1 of the Chihuahuan Desert and Rio Grande valley.

Psorothamnus sect. **Psorothamnus.** *Psorothamnus* Rydb., sens. str. — This section appears to be the most advanced group in the genus, resembling *Dalea* in its ebracteolate flowers and small seeds and pods, at the same time differing from sect. *Xylodalea* in these same characters and additionally in the gland-tipped connective. The species are abruptly and widely differentiated from one another, each richly endowed with strong morphological characters conspiring toward an idiosyncratic aspect. In this respect they differ markedly from the closely interrelated members of sect. *Xylodalea*.

Unusual morphological characters shared by one or more species of sect. *Psorothamnus* are retrorse stem-pubescence, foliage of variably reduced type, and externally pubescent or marcescent petals. These characters, however, are not securely linked, but occur in various combinations. Characters peculiar to only one species of the section are the long pedicels and prickly sterile shoots (probably modified inflorescences) of *Ps. thompsonae* (the last somewhat reminiscent of *Ps.* (*Winnemucca*) *kingii*); the rushlike habit and blue petals of *Ps. scoparius*; the tomentulose vesture (not retrorse on the stems) and proportionately short banner of *Ps. emoryi*; the stiff divaricate branching of *Ps. polydenius*. No two species of the section are truly sympatric, although *Ps. polydenius* and *Ps. emoryi* almost converge on the southern Mohave Desert and *Ps. polydenius* and *Ps. scoparius* each have established a marginal foothold in the canyonlands of the Colorado Plateau, to which *Ps. thompsonae* is endemic.

Key to the Species of Sect. *Psorothamnus*

1. Terminal leaflets of main cauline leaves (when pinnate) longer (usually much longer) than the lateral ones, the upper leaves, in one species almost all leaves, reduced to a simple terminal blade or 3-foliolate; flowers sessile or subsessile; *petals* deciduous, and at least the keel pubescent externally; Sonoran and Chihuahuan deserts, Baja California to Coahuila n. to s.-e. Mohave Desert in California and the Yuma Desert in s.-w. Arizona, one extending up the Rio Grande valley from trans-Pecos Texas through New Mexico and n.-w. feebly into n.-e. Arizona.
   2. Leaves highly variable in form, but some cauline ones ordinarily pinnate, with 2–6 pairs of leaflets, usually only the uppermost (rarely all) 1–3-foliolate; *pubescence* of both stems and leaves tomentulose (rarely 0); *banner* shorter than keel, its blade 2.8–4.8 mm long, pubescent externally; diffusely branched shrubs of the Sonoran Desert, mostly below 400 m, in s.-e. California and adjoining Arizona, n.-w. Sonora and wisely dispersed in Baja California. 6. *Ps. emoryi.*
   2. Leaves subhomomorphic, all simple or some few cauline ones 3-foliolate; *pubescence* of stems retrorsely subappressed, that of foliage ascending-pilosulous; *banner* ± as long as keel, its blade 5–6.6 mm long, glabrous dorsally; broomlike shrubs with many erect but pliant, leafless or sparsely leafy stems, of the Chihuahuan Desert above 1000 m, extending n. from w. Coahuila through Rio Grande valley into n.-centr. New Mexico and feebly into n.-e. Arizona. 7. *Ps. scoparius.*

1. Terminal leaflets of all leaves shorter or about as long as the 3–8 pairs of lateral ones, the upper leaves never simple or 3-foliolate; *flowers* pedicelled, but pedicels in *Ps. polydenius* sometimes short and obscure; *petals* marcescent; deserts of s.-w. United States from centr. Mohave n. and w. to Great and Colorado basins.
   3. Racemes relatively dense, often subcapitate, the axis mostly less than 1.5 (in Utah rarely up to 3) cm long; *pedicels* 0.2–8 mm long; *calyx-teeth* triangular- or lance-acuminate, the dorsal one longest; *petals* pubescent externally, the wings gland-tipped; Nevada and s.-e. California, locally to extreme s.-w. and e.-centr. Utah. Ultimate sterile shoots stiff but not prickly. 8. *Ps. polydenius.*
   3. Racemes loose and open, the axis (1) 2–9 cm long; *pedicels* 0.7–1.4 mm long; *calyx-teeth* ovate, the very broad ventral pair longest; petals glabrous, the wings eglandular; canyons of Colorado and Little Colorado rivers in e.-centr. Utah and n. Arizona. Sterile shoots below inflorescence stiff and prickly. 9. *Ps. thompsonae.*

6. Psorothamnus emoryi (Gray) Rydberg
(Plates V, VI)

Early suffrutescent herbs, rarely flowering prematurely as herbaceous annuals, commonly becoming rounded shrubs or subshrubs 3–10 dm tall and up to twice as wide, most often densely and softly tomentulose throughout with fine, spreading or subretrorse, ± entangled hairs up to ± 0.2–0.4 mm long, rarely the stems alone or both stems and foliage together glabrescent to fully glabrous, these then deep green and dotted all over with reddish-orange glands (always present, but here revealed), the foliage drought-deciduous, the plant becoming in dry seasons ± junceous and cancellate; *leaf-spurs* almost 0; *stipules* subulate, 0.6–1.1 mm long, commonly tomentulose, charged on margins with a pair of orange glands, caducous; *intra-petiolular glands* 0; *post-petiolular* glands small but prominent, sometimes concealed by woolly vesture; *leaves* polymorphic and variable both from one plant to another and according to position on the stem, the main cauline ones usually with 2–4 (6) pairs of lateral leaflets varying from suborbicular-emarginate to oblong-oblanceolate or elliptic and from 2 to 10 mm long, the terminal leaflet always longer, usually narrower, obovate to oblanceolate or sublinear, mostly 4–16 (20) mm long, all flat or nearly so, the margins either entire or crenulate-dentate, gland-charged on both faces but the glands often concealed by vesture, the upper (sometimes all) leaves shorter and simpler, 3-foliolate or reduced to a subsessile blade, the uppermost often minute and bracteiform; *peduncles* leaf-opposed and terminal to all ultimate branchlets, 0.5–12 cm long; *spikes* dense, mostly capitate and subglobose, rarely oblong, without petals 7.5–13 (15) mm diam, the pilosulous axis becoming (1) 3–20 mm long; *bracts* early deciduous, narrowly lance-elliptic or subulate to sublinear, 1.5–3 mm long, pilosulous dorsally, the margins usually charged with 1–3 pairs of subulate orange glands; *pedicels* 0 (rarely to 0.2 mm long); *bracteoles* represented by 2 minute orange spicules; *calyx* (2.7) 3–6.6 (7.2) mm long, pilosulous with fine weak ascending hairs up to 0.4–0.8 mm long, the golden-yellow tube 1.7–3.4 mm long, its ribs slender becoming prominent, the intervals charged with 1–2 rows of small orange glands, the 1-nerved teeth varying from lance-acuminate to ovate-triangular and from ± 1 mm shorter up to 1 mm longer than tube, all gland-tipped and -spurred, the sinus behind the banner sometimes shallower than the rest; *petals* (deciduous) usually bicolored, the banner-blade margined and the inner petals banded along inner half with vivid purple or violet, otherwise paler or whitish, the blades of banner, keel, and often of wings also, pilosulous externally in

distal ½–⅓; *banner* 4.2–6.3 mm long, the claw 1.6–2.3 mm, the ovate-cordate, apically emarginate blade 2.8–4.8 mm long, 2.4–4.1 mm wide, charged near apex dorsally with a prominent blister-gland; *wings* 5.2–7.8 mm long, the claw 1.6–2.6 mm, the narrowly oblong or oblong-oblanceolate, gland-tipped blade (3.5) 3.8–5.2 mm long, 1.3–1.8 mm wide; *keel* 5.7–8.5 mm long, the claws 1.7–3.3 mm, the obliquely oblong-obovate or broadly obovate blades 3.7–6.2 mm long, (2) 2.2–2.9 mm wide, usually glandless; *androecium* 5.7–7.8 mm long, the connective gland-tipped, the anthers 0.5–0.9 mm long; *stigma* slightly enlarged, subcapitate; *pod* subsymmetrically obovoid-ellipsoid, 2.3–2.8 mm long, cuneately narrowed and glabrous at base, pilosulous and gland-sprinkled distally, the style-base terminal; seed (little known) ± 1.5 mm long, the testa smooth, brown, dull, paler at the hilum and sometimes with a fuscous line above it.

I adopt here the comprehensive definition of *Ps. emoryi* proposed (under *Dalea*) by I. Johnston (1924, pp. 1046–7). While in full agreement with Johnston that five species of *Psorothamnus* from the Sonoran Desert maintained by Rydberg (*Ps. emoryi, tinctorius, dentatus, arenarius*, and *junceus*) can readily be accommodated in one, I differ in my view of the internal racial situation. Johnston referred all tomentose plants of this type to a typical variety of wide dispersal, but recognized two glabrescent or glabrate varieties, a northern var. *junceus* and a southern var. *arenarius*. With more extensive material now available, it appears that these pubescence-variants are unstable and reasonably treated as taxonomically unimportant formae, although it cannot be denied that they are visually striking. In this connection Dr. A. Carter's observations of the southern glabrate form known as var. *arenaria*, as this grows on El Mogote peninsula in La Paz bay, are especially significant. Here a canescently woolly form was found at both ends of the peninsula and a glabrous one in the middle, the plants (*Carter 2716, 2730, 2744*, all UC) being otherwise essentially similar. Forms of *Ps. emoryi* with glabrate stems but foliage still tomentulose have been found growing close to fully glabrate individuals in the neighborhood of Bahía de los Angeles. The division of *Ps. emoryi* into a northern and southern variety, each of which presents a glabrescent phase, follows lines already drawn by Wiggins (1940, pp. 48, 49, pl. VIII); Wiggins treated these geographic entities as species, but I have found no reliable single differential character by which to distinguish them. As a rule the northern var. *emoryi* has a longer calyx, with absolutely and proportionately longer teeth of narrower outline; and the sinus between the pair of dorsal calyx-teeth is characteristically shallower than in its southern counterpart, var. *arenarius*. The petals of var. *emoryi* are vivid pink-purple, those of var. *arenarius* violet or bluish-purple. The adult plant of var. *emoryi* is genuinely shrubby, although the young growth may be soft and pliant, whereas the common forms of var. *arenarius* in the Cape region are herbaceous, flowering precociously and perhaps less enduring. There are exceptions, however, and intermediate forms. In Baja California Sur northward from La Paz the calyx and petal-color of var. *arenarius* is often combined with a shrubby habit, while in one Sonoran station at Kino Point (*Johnston 4286*; *Wiggins & Rollins 169*, both NY) the small calyx of var. *arenarius* is combined with the rose-purple coloring as well as the fruticose habit of var. *emoryi*. The collective range of all forms of *Ps. emoryi* extends without interruption from Coachella Valley in the north to Bahía La Paz in the south, a zone of transition between var. *emoryi* and var. *arenarius* occurring about midway down the Peninsula in latitudes 26° 30′–28° 30′.

Key to the Varieties of *Psorothamnus emoryi*

1. Calyx (4.1) 4.3–7.2 mm long, the tube (2.2) 2.4–3.4 mm long (measured to a lateral sinus), the lance-acuminate lateral and dorsal teeth 1.8–3.8 mm long, the dorsal sinus less deeply recessed than the rest, the orifice thus oblique; *banner* mostly 5.3–6.3 mm

long, the margin of blade pink-purple; Colorado and extreme s.-e. Mohave deserts in s.-e. California, extreme s.-w. Arizona, coastal n.-w. Sonora, and s. in Baja California (e. of San Pedro Mártir) to vicinity of Mulegé near 26° 30′ 6a. var. *emoryi*.

1. Calyx (2.7) 3–4.1 (5) mm long, the tube 1.7–2.5 (3) mm, the triangular or ovate teeth (1.1) 1.3–1.8 (2) mm long, the sinuses all of about equal depth, the orifice therefore not or scarcely oblique; *banner* mostly 4.2–5.3 mm long, the margin of blade violet- or bluish-purple; Baja California Sur, from vicinity of San Ignacio (near 27° N) s. through Viscaíno Desert and through the Gulf islands adjoining the peninsula to Bahía La Paz and vicinity, extending w. to the Pacific coast and n. sparingly into extreme s. Baja California Norte, to ± 28° 30′. 6b. var. *arenarius*.

6a. Psorothamnus emoryi (Gray) Rydberg var. emoryi

(Plate VI)

Suffruticose becoming shrubby, usually white-tomentulose throughout, the stems (rarely the foliage also) occasionally glabrescent or glabrous; *stems* appearing only sparsely verruculose, the glands mostly concealed by vesture, but becoming prominent in glabrescent forms; *terminal leaflet* of most leaves 4–16 (20) mm long; *spikes* nearly always capitate, rarely oblong, (9) 10–13 (15) mm diam at anthesis, the axis (1) 3–11 mm long; *calyx* as described in key; *keel* 6–8.5 mm long, the obliquely oblong-obovate blades 4.2–6.2 mm long, (2) 2.2–2.9 mm wide; *androecium* 6.3–7.8 mm long; 2n = 10_{II} (Raven, Kyhos & Hill, 1965); n = 10 (Spellenberg, 1973). — Collections: 99 (v.v.).

Dunes, sandy flats, washes, mostly below 350 m, exceptionally up to 760 m near its n. limit and in Salton Depression down to −35 m, widespread and locally abundant around the n. and w. edges of the Sonoran Desert, from Coachella Valley, Riverside County, California s. to and just beyond the boundary between Baja California Norte and Sur, but not extending w. to the Pacific, e. in California to extreme s.-e. Mohave Desert in s.-e. San Bernardino County (between 29 Palms and Amboy), and to the lower Colorado Valley in e. Riverside and Imperial counties, thence crossing into the lower Gila valley and vicinity in Yuma and w. Pima counties, Arizona and s. in coastal Sonora from the Colorado delta to Puerto Kino and neighboring Isla Tiburón. — Flowering April to June, sometimes again in fall, or in Baja California following rains out of season. — *Representative*: UNITED STATES. California: San Bernardino: *Munz 11,721* (NY, POM, SD). Riverside: *Parish 4112* (NY, UC), *Balls & Everett 23,023* (NY, UC). San Diego: *Duran 3181* (NY, UC, WIS); *Abrams 3180, 3987* (NY). Imperial: *Ferris 7135* (NY); *Munz & Hitchcock 12,113* (POM, UC). Arizona. Yuma: *Schott* (Mex. Bound. Surv.) *237a* (NY); *Thornber 2399* (UC). Pima: *Ora Clark 11,233* (WIS). MEXICO. Sonora: *Hastings et al. 62–72* (ARIZ); *Whiting 9044* (ARIZ); *I. Johnston 3247* (UC). Baja California (Edo.): *Wiggins 3023* (UC), *5370* (F, NY); *I. Johnston 3344, 4231* (NY, UC); *Moran 8172, 8593* (SD), *8673* (NY, SD). Baja California (Sur): *Moran 11,621* (NY, SD).

Psorothamnus emoryi (Gray) Rydb., N. Amer. Fl. **24**: 47. 1919, based on *Dalea emoryi* (William Hemsley Emory, 1811–1887) Gray, Mem. Amer. Acad. II, **5** (Pl. Thurb.): 315. 1854 ("*Emoryi*"). — "On the desert table-lands of the Gila, June, 1852. — This was first gathered by Colonel Emory...and is the second species mentioned by Dr. Torrey, in Emory's report, p. 139)." — Holotypus, *Thurber 677*, from 'Tablelands, Gila, 18 Apr.', GH! paratypus, *Emory*, Nov. 28, 1846, NY (herb. Torr.)! — *Parosela emoryi* (Gray) A. Hell., Cat. N. Amer. Pl. ed 2, 6. 1900.

Psorothamnus junceus (rushy, of the stems) Rydb., N. Amer. Fl. **24**: 48. 1919. — "Type collected in the Esperanza Canon, San Pedro Martir Mountains, Lower California, June 27, 1905, *Goldman 1178*..." — Holotypus, US! clastotypus (fragm.), NY! — *Parosela juncea* (Rydb.) Standl., Contrib. U. S. Nat. Herb. **23**: 462. 1922. *Parosela emoryi* var. *juncea* (Rydb.) I. Jtn., Proc. Calif. Acad. Sci. IV, **12**: 1047. 1924. *Dalea juncea* (Rydb.) Wiggins, Contrib. Dudl. Herb. **3**(2): 49. 1940.

At anthesis in late spring and early summer on the floor of the Colorado Desert, var. *emoryi* is a showy small shrub, often wider than tall, covered all over with countless fluffy balls of rosy-purple flower. Later in the year the foliage disjoints, leaving only a dense tangle of gray interlacing branchlets. North of the border var. *emoryi* is so densely tomentulose throughout that only a few of the larger orange glands on the stems and peduncles are visible externally, but these are fragile, yielding when bruised a strong-smelling, orange oil. Even in the part of its range lying within California, var. *emoryi* shows much variation in size of calyx and in proportion of calyx-tube to teeth. These vary from ± 0.8 mm shorter up to ± 1.2 mm longer than the tube as measured from base up to a lateral sinus. Quite typical var. *emoryi* extends south in Baja California to the latitude of Bahía de los Angeles and Isla Angel de la Guardia, but toward its southern limit the pubescence tends to become thinner, at first on the stems alone, finally throughout the plant. A form with green and glabrous, red-dotted stems (*Harbison 41,717, 41,767,* SD) but foliage still gray tomentulose, provides passage into the comparatively rare form with hairless leaves described by Rydberg as *Psorothamnus junceus.* The range of the latter is apparently confined to the east foothills of Sierra San Pedro Mártir and adjoining Gulf coastal plain (s. to El Huerfanito in lat. 30° 05′ N, *Moran 10,349*, SD, UC, US). It was maintained provisionally by Wiggins, partly because of its growth-habit, partly because of an unequally toothed calyx. Moran's collection just cited, however, has the relatively coarse, rigidly zigzag-divaricate branching characteristic of the tomentose form, which, as already noted above, varies greatly in length of calyx-teeth.

As in other members of sect. *Psorothamnus*, the petals of *Ps. emoryi* quickly stain fingers or drying-papers with a purple juice, and the calyces are said (Jaeger, 1940, Desert Wild Flowers 110) to yield a saffron dye used by Indians of the Colorado Desert. Around the mouth of the Colorado River in extreme southeastern California and adjoining Arizona var. *emoryi* is host to the rafflesiaceous stem-parasite *Pilostyles thurberi* Gray.

6b. Psorothamnus emoryi var. arenarius (Brandegee) Barneby
(Plate V)

Frutescent in age but flowering as a herb, sometimes in its first year of growth, varying from densely white-tomentulose to thinly gray-tomentulose or almost glabrous up to the inflorescence; *stems* densely verruculose with prominent orange glands, many of them emergent above the tomentulose vesture; *terminal leaflet* mostly 1–2.5 (3.5) cm long, rarely only 0.5–1 cm; *spikes* either capitate or becoming oblong-cylindroid, 7.5–10 mm diam at anthesis, the axis (3) 5–20 mm long; *calyx* as described in key, the glands on tube mostly fewer than in var. *emoryi*, 3–6 in 1 row; *keel* ± 5.7–6.7 mm long, the obovate blades 3.7–4.6 mm long, 2.4–2.9 mm wide, proportionately broader than in var. *emoryi*; *androecium* 5.7–7 mm long; n = 10 (Spellenberg, 1973). — Collections: 47 (o).

Dunes both maritime and interior, sandy washes, occasionally on rocky hillsides, mostly below 300, rarely up to 400 m (1200 ft), common and locally abundant, in places forming open thickets, deserts of Baja California Sur northward on both coasts from the latitude of Bahía La Paz, especially abundant on sandy plains of Viscaíno Desert, e. to the Gulf islands (Islas San Francisco, San José, Catalina, Monserrate, and Tor-

tuga), and extending feebly n. of the boundary at 28° N into extreme s. Baja California Norte, at its n. limit intergradient to var. *emoryi*. — Flowering both in spring and summer, following rains, occasional in fall and winter. — *Representative*: BAJA CALIFORNIA (Sur): *Wiggins 5562* (NY, UC), *7919* (F), *16,263* (ENCB); *Gentry 3774, 4050, 2496, 7351, 7690* (ARIZ, UC); *Shreve 7045* (ARIZ, F); *I. Johnston 3715* (NY, UC); *Moran 7475* (NY), *9423*, *9454* (SD). BAJA CALIFORNIA (Edo.): typus of *D. tinctoria*, cited below; *Hastings & Turner 67–84* (SD).

Psorothamnus emoryi var. **arenarius** (Brandegee) Barneby, comb. nov., based on *Dalea tinctoria* var. *arenaria* (sandy, of the habitat) Brandg. Proc. Calif. Acad. Sci. II, **2**: 147. 1889. — "Sands of the sea-shore, Boca de Soledad [s.-e. of La Paz]." — Holotypus, collected Jan 28, 1889, UC! — *Psorothamnus arenarius* (Brandg.) Rydb., N. Amer. Fl. **24**: 47. 1919. *Parosela arenaria* (Brandg.) Standl., Contrib. U. S. Nat. Herb. **23**: 462. 1922. *P. emoryi* var. *arenaria* (Brandg.) I. Johnst., Proc. Calif. Acad. Sci. IV, **12**: 1047. 1924.

Dalea tinctoria (dyeing, of the fragile orange glands) Brandg., Proc. Calif. Acad. Sci. II, **2**: 147. 1889. — "San Gregorio [near 28° 40′ N, 113° 40′ W]." — Holotypus, collected Feb 7, 1889, UC! — *Psorothamnus tinctorius* (Brandg.) Rydb., N. Amer. Fl. **24**: 47. 1919. *Parosela tinctoria* (Brandg.) Standl., Contrib. U. S. Nat. Herb. **23**: 462. 1922 (Jul 14); Macbr., Contrib. Gray Herb., New Ser. **65**: 16. 1922 (Sep 13).

Psorothamnus dentatus (toothed, of the leaflets) Rydb., N. Amer. Fl. **24**: 47. 1919. — "Type collected at Santo Domingo [del Pacífico], Lower California, September 26, 1905, *Nelson & Goldman 7170...*" — Holotypus, US! clastotypus (fragm), NY! — *Parosela dentata* (Rydb.) Standl., Contrib. U. S. Nat. Herb. **23**: 462. 1922.

The var. *arenaria* as known to Brandegee is a subherbaceous, thinly pubescent, mostly maritime phase of *Ps. emoryi* in which the flower-spike tends to become oblong-cylindroid rather than globose in age. Its short, almost symmetrically campanulate calyx and violet-margined petals, however, are found also on shrubby plants with aspect and habit of var. *emoryi* as this occurs in the Colorado Desert far northward. Plants of the latter type, that is with the habit of var. *emoryi* but a modified flower, correspond with *D. tinctoria* sens. str. Wiggins (1940, p. 48–49) has pointed out that these two forms have a common and almost equally extensive range in Baja California, and they appear to be artificial segregates, possibly reflecting seasonal rather than genetic variation.

Some specimens from the Gulf islands are in one way or another intermediate between var. *emoryi* and var. *arenarius*. As far south as Isla Catalina Moran collected an individual variant (*No. 9328*) which has the violet petals and relatively broad and short-toothed calyx of var. *arenarius*, but the calyx-tube is abnormally long (3 mm) for the latter and the ventral pair of teeth is partially united behind the banner as in var. *emoryi*. At Kino Bay in coastal Sonora facing Tiburón Island an often sampled population of *Ps. emoryi* has with the pink-purple petal coloring of var. *emoryi* a small calyx approaching that of var. *arenarius*. The whole range of *Ps. emoryi* extends north and south about 1400 km. While there is much evidence that genetic drift is operating toward the segregation of northern and southern entities, this separation has not yet reached the point of establishing discrete species.

7. PSOROTHAMNUS SCOPARIUS (Gray) Rydberg
(Plate V)

Sparsely leafy, in late summer almost leafless broomlike shrubs or subshrubs up to 1 m tall, with many pliantly erect and incurved-ascending, freely forking stems densely gray-strigulose with short, appressed or subappressed, retrorse, partly scalelike hairs and thickly charged with small orange blister-glands, the sparse deciduous foliage greenish-gray, more thinly stigulose than the stems with antrorsely subappressed hairs,

the inflorescence gray-pilosulous; *leaf-spurs* 0.2–1 mm long; *stipules* subulate, 0.3–0.7 mm long, livid-glandular and glabrous at tip, deciduous; *post-petiolular glands* 0, or in 3-foliolate leaves small and prominent; *leaves* (2) 4–20 mm long, mostly simple, composed of a short petiolule and a terminal, linear-oblanceolate, retuse, thick-textured, folded leaflet prominently tuberculate beneath, a few (but not on all plants) developing a petiole+rachis up to 5 mm long bearing at apex a terminal and 2 much smaller but otherwise similar leaflets; *peduncles* terminal to all ultimate branchlets, 0.5–9 cm long; *racemes* short but not dense, mostly ± 5–15-flowered, ovate in outline, without petals (7) 8–10 mm diam, the hirsutulous axis becoming (1) 3–18 mm long, sometimes a few flowers scattered below the main spike; *bracts* early deciduous, papery, ovate- or oblanceolate-acuminulate, gland-tipped, pilosulous dorsally, 1.5–2.5 mm long; *pedicels* thick, 0–0.4 (0.7) mm long, densely pilosulous, charged with a pair of orange glands distally; *calyx* 3.5–4.5 mm long, densely gray-pilosulous, subspathaceous, the tube (measured to a dorsal sinus) 2.2–3 mm long, the ribs moderately prominent, the submembranous intervals charged with 1 row of (1) 2–5 orange glands, the ovate teeth unequal, the ventral pair longest and broadest, united to within 1 mm of tips but (1) 1.3–2 mm long measured from a lateral sinus, the dorsal tooth shortest and narrowest, all charged at tip and on each lateral margin with a blunt gland; *petals* (deciduous) vivid blue or blue-violet (exceptionally white), all or all but keel charged with apical glands; *banner* 6.4–9 mm long, the forwardly arched claw 2–2.7 mm, the oblong-obovate, basally cordate, apically notched blade 5–6.6 mm long, 3.6–4.2 mm wide; *wings* 7.1–9.1 mm long, the claw 2.1–2.8 mm, the narrowly oblong-oblanceolate, obliquely notched blade 5–6.7 mm long, 1.7–2.1 mm wide; *keel* 6.1–8.3 mm long, the claws 1.8–2.9 mm, the obliquely obovate, glabrous or thinly puberulent blades (4.2) 4.6–5.8 mm long, 2.1–3.5 mm wide; *androecium* 10-merous, 5.5–8.5 mm long, the longer filaments free for 2.3–2.6 mm, the connective gland-tipped, the anthers 0.6–0.85 mm long; *pod* slightly exserted, ± 4 mm long, glabrous at base, pilosulous and gross-glandular distally; *seed* castaneous, sometimes purple-speckled, 2.1–2.7 mm long; n = 10 (Spellenberg, 1973). — Collections: 44 (vi).

Dunes and sandy river-beds, locally abundant, 1100–1530 m (± 3670–5100 ft), very common along the Rio Grande from near Albuquerque, Bernalillo County, New Mexico downstream to El Paso and immediately adjoining Hudspeth counties, Texas, in New Mexico interruptedly e. to the White Sands in Otero County, and w. to Luna County and (isolated) the Wilcox playa in Cochise County, Arizona, s. to the great dunes of n. Chihuahua in mpos. C. Juárez and Villa Ahumada; apparently disjunct around margins of Bolsón de Mapimí in w.-centr. Coahuila (Mohovano; Sa. del Rey) and immediately adjoining s.-e. Chihuahua. — Flowering June to October. —*Representative*: UNITED STATES. ARIZONA. Cochise: *Shreve 4256* (UC). NEW MEXICO. Bernalillo: *Jones 4135* (BR, NY, POM, UC); *Heller 15,796* (NY, UC). Valencia: *Barneby 13,840* (CAS, DS, GH, NY, US). Socorro: *McVaugh 3907* (UC); *Barneby 13,846* (NY). Doña Ana: *Wooton 9* (NY, UC); *Barneby 13,850* (CAS, NY). Otero: *Cutler 2017* (UC). Luna: *Shreve 8226* (UC). TEXAS. El Paso: *Waterfall 3904* (NY); *Warnock 5761* (OKLA, RENNER). Hudspeth: *Warnock 13,766* (RENNER, TEX). MEXICO. CHIHUAHUA. Ciudad Juárez: *Pringle 719* (BR, F, M, MEXU, NY, UC, W). Villa Ahumada: *Gentry 8213* (MEXU, UC); *Ripley & Barneby 13,854* (CAS, NY). Jiménez: *Mueller 3320* (UC). COAHUILA. Sierra Mojada: *Purpus 4491* (F, UC).

Psorothamnus scoparius (Gray) Rydb., N. Amer. Fl. **24**: 48. 1919, based on *Dalea scoparia* (broomlike) Gray, Mem. Amer. Acad. II, **4** (Pl. Fendl.): 32. 1849. — "Jornada del Muerto, between Santa Fe and El Paso del Norte, *Dr. Wizlizenus*." — Holotypus, *Wislizenus 86*, GH! — *Parosela scoparis* (Gray) A. Hell., Catal. N. Amer. Pl., ed. 2, 7. 1900.

Dalea scoparia fma. *subrosea* (pinkish) Cockerell, Science, new ser. 7: 625. 1898.—"Mesilla [Doña Ana County], New Mexico, 3800 feet above sea level."—No typus found; described as a form with magenta petals.

Parosela scoparia fma. *arsenei* Standl., Field Mus., Bot. 17: 195. 1937.—"NEW MEXICO: Four miles north of Bernalillo, 1,600 meters, September 4, 1927, *Brother G. Arsène 18988*..."—Holotypus, F!

A highly modified xerophytic shrub adapted to a dune habitat which it shares with mesquite and sometimes with Larrea, like them arresting the drift of blown sand by their tangled branches and forming hummocks. The combination of almost leafless (in summer truly leafless) stems clad in retrorsely subappressed hairs and speckled with little orange blister-glands with many small headlike racemes of blue (in fma. *subrosea* purple, in fma. *arsenei* albino) flowers distinguishes the species from all others. While the reduced foliage recalls *Ps. emoryi*, the retrorse pubescence points to closer relationship with the intermontane *Ps. thompsonae* and *Ps. polydenius*, which differ collectively in their marcescent petals and stiffly divaricate or zigzag mode of branching. The pliant broomlike stems of *Ps. scoparius* curiously resemble those of *Psoralea juncea* Eastw., a denizen of dunes in the Colorado Basin.

According to Kearney and Peebles (1960, p. 436) *Ps. scoparius* occurs disjunctly on the headwaters of the Little Colorado River in Coconino County, Arizona (near Leupp, *Whiting 3321*). No corresponding specimens were found in 1970 at US and more direct evidence of this surprising range-extension is required.

8. Psorothamnus polydenius (Torrey) Rydberg
(Plates VI, VII)

Stiffly angular, divaricately branching shrubs up to 0.4–1 (1.5) m tall, the stout aged stems leafless, the ultimate twigs becoming subspinose after shedding the terminal flower-racemes, the younger stems densely silky-pilosulous with retrorsely subappressed or narrowly descending lustrous hairs up to 1.5–4 mm long, and densely sprinkled with orange blister-glands (often when dried collapsing and saucer-shaped), the foliage pilosulous with loosely ascending, spreading, or subappressed hairs up to 0.25–0.5 mm long, the ashen leaflets pubescent both sides, rarely thinly so and greenish, charged beneath with 1 subapical and 1–3 pairs of livid submarginal glands; *leaf-spurs* subobsolete up to 1 mm long; *stipules* fugacious, triangular or subulate, gland-tipped, 0.4–1 mm long; *leaves* mostly 7–15, rarely 27 mm long, subsessile or shortly petioled, with 3–6 pairs of obovate, obovate-cuneate, or suborbicular, emarginate or retuse flat or loosely folded leaflets 1–4.5 mm long; *peduncles* leaf-opposed and terminal to firm tapering branchlets; *racemes* usually dense but not at all conelike, ovoid to globose or rarely oblong-cylindroid, without petals 10–14 mm diam, the pilosulous axis finally 3–30 mm long; *bracts* deciduous, lanceolate or lance-attenuate, pilosulous dorsally, tipped with a subcapitate gland; *pedicels* 0.2–0.7 (0.8) mm long, charged near base and apex with pairs of small orange glands; *calyx* 3.9–5.3 (8.3) mm long, pilosulous externally from base upward or only on the teeth, the tube (measured to a lateral sinus) 1.9–2.8 (3) mm long, its ribs becoming prominent but remaining slender, the membranous intervals charged with 1 row of 2–4 (the ventral intervals with up to 6, more scattered) glands, the ventral sinus less deeply recessed than the lateral ones and the orifice therefore oblique, the teeth varying from triangular-acuminate to narrowly lance-acuminate or -caudate, the dorsal one longest, either a little shorter or longer than tube, the ventral pair broadest and shortest; *petals* marcescent, all opening pink-purple, the banner with a golden eye-spot, this and wings gland-tipped, the keel usually glandless; *banner* 4.6–6.1 (6.6) mm long, the antrorsely arched claw 2–2.5 (2.8) mm,

the ovate-cordate, emarginate or retuse blade 3.2–4.2 (4.6) mm long, 2.7–4.6 mm wide; *wings* 5.4–7 mm long, the claw 1.9–2.5 (2.8) mm, the narrowly oblong, obtuse or truncate-emarginate blade 4–5 (5.4) mm long, 1.5–2.1 mm wide; *keel* 5.7–8 mm long, the claws (1.9) 2.2–3 mm, the broadly obovate blades (3.7) 4–5.3 mm long, 2.4–3.7 mm wide; *androecium* 5.2–6.8 mm long, the connective gland-tipped, the anthers (0.55) 0.6–0.8 (1) mm long; *ovules* 2, collateral; *pod* ± 2.5 mm long, obliquely clavate-obovoid, the style-base lateral, the valves glabrous and hyaline at base, distally rugulose, thinly pilosulous, gross-glandular; *seed* (seldom seen) 2–2.2 mm long.

A small angularly crooked shrub, the young stems clad in lustrous deflexed hairs and dotted with many red or orange resinous blisters. In the Great Basin and Mohave Desert *Ps. polydenius* is the only member of the genus characterized by retrorse stem-pubescence. Its disjunct representative on Green River in east-central Utah approaches the range of the related *Ps. thompsonae* which differs, however, in relative proportions of calyx-teeth and glabrous (not externally pubescent) petals. The small upper branchlets of *Ps. polydenius* harden into stout but blunt thorns; there are, however, no subterminal inflorescences modified into truly spinose branchlets, a feature of *Ps. thompsonae* not matched elsewhere in the genus. The main range of *Ps. polydenius* extends through the basins and desert valleys lying in the rain-shadow of Sierra Nevada from the Humboldt and Carson sinks south into central Mohave Desert, with outlying stations on the Virgin and Meadow Valley affluents of the Colorado in extreme s.-w. Utah and adjoining Nevada. A disjunct population on Green River in e.-centr. Utah, still little known, seems to differ enough to deserve taxonomic recognition.

The epithet *polydenius* was originally so spelled by Torrey (in herb., NY) and published by Watson in the same form. The correction to *polyadenius*, widely adopted in the literature, is to be condemned.

Key to the Varieties of *Psorothamnus polydenius*

1. Calyx relatively short, the teeth triangular-lanceolate, 1.8–2.5 mm long, 0.3 mm longer to 0.9 mm shorter than tube; *bracts* 1.6–2.5 mm long, gland-spurred on margin but otherwise entire; *racemes* short and dense, usually shortly ovoid to globose, the axis becoming 3–12 (18) mm long; Great Basin and Mohave Desert, w. Nevada, adjoining California, e. interruptedly to extreme s.-w. Utah.
   8a. var. *polydenius*.
1. Calyx longer, the teeth lance-attenuate and up to 3.6–5.2 mm long, at least 1 mm longer than tube; *bracts* linear-lanceolate or -caudate, 4–6.5 mm long, commonly toothed on either side; *racemes* longer and looser, ovoid becoming oblong in outline, the axis mostly 2–3 cm long; local in Colorado Basin, e.-centr. Utah.
   8b. var. *jonesii*.

8a. Psorothamnus polydenius (Torrey) Rydberg var. polydenius
(Plate VI)

Leaves small, distant, the leaflets 3–6 pairs, obovate to suborbicular, 1–3 mm long; *calyx* either pilosulous equably from base upward (the hairs up to 0.3–0.6, rarely 0.7 mm long), or the tube externally glabrous and lustrous, only the teeth pilosulous; otherwise as in key; $2n = 10_{II}$ (Raven, Kyhos & Hill, 1965); $2n = 10$ (Spellenberg, 1970). — Collections: 54 (o, sed pluries sterilem vidi).

Sandy and gravelly, often alkaline flats and low hills, commonly associated with chenopods, sometimes on dunes, 880–2250 m (2930–7500 ft), forming colonies but seldom crowded into thickets, widespread through the basins of w. Nevada and along e. foothills of Sierra Nevada in adjoining California from Smoke Creek Desert and the Humboldt and Carson sinks s. to Owens Valley, and somewhat disjunctly to central Mohave Desert in San Bernardino County, in Nevada s. to s. Nye County and thence e., rarely, to the Beaver Dam Mountains in s.-w. Washington County, Utah. — Flowering mid-May to September, the fruits ripe from July onward. — *Representative*: CALIFORNIA. Mono: *Heckard & Bacigalupi 3511* (NY, SD); *Balls & Lenz 21,865* (RSA, UC); *Spellenberg 2108* (NY). Inyo: *Duran 3316* (NY, UC); *Raven 7001* (NY); *L. S. Rose 42,188* (CAS, NY); *Alexander & Kellogg 5304* (SD, UC). San Bernardino: *Everett, Balls & Lenz 17,611* (NY, OKLA, RSA); *Alexander & Kellogg 2311* (UC); *Beal 597* (JEPS, WIS). NEVADA. Washoe: *Palmer 66 in 1876* (NY, UC, US); *Munz 16,116* (UC); *Griffiths & Hunter 491, 544* (NY). Humboldt: *Train 3096* (NY, UC). Churchill: *Kennedy 1709* (NY). Lyon: *Hendrix 693* (UC). Mineral: *O. C. Stewart 53* (UC). Esmeralda: *Shockley 275* (NY, UC); *Maguire & Holmgren 25,513* (NY, UC). Nye: *Maguire & Holmgren 10,558* (NY, UC), *25,175* (NY); *Reveal & Holmgren 1855* (NY). Lincoln: *Hermanson 113* (UC). UTAH. Washington: *Nish 44* (NY).

Psorothamnus polydenius (Torr. ex Wats.) Rydb., N. Amer. Fl. **24**: 46. 1919 ("*polyadenius*"), based on *Dalea polydenia* (with many glands) Torr. ex Wats. in King, Geol. Exp. 40th Parallel, Botany 64, Pl. IX. 1871. — "Border of Truckee Desert, Nevada; (W. W. Bailey) 4,200 feet altitude; July...First collected by Dr. Torrey near Carson Desert." — Lectotypus, *Torrey 109bis*, collected in 1865, GH! isotypus, NY (herb. Torr.)! paratypi, *Bailey distrib. Wats. 251*, GH, NY! — *Parosela polydenia* (Torr. ex Wats.) A. Hell., Catal. N. Amer. Pl. ed. 2, 6. 1900 ("*polyadenia*").

Dalea polydenia Torr. ex Wats. (?) var. *subnuda* (almost naked, of glabrate calyx-tube) Wats. in Brew. & Wats., Bot. Calif. **2**: 441. 1880. — "Owen's Valley, *Dr. W. Matthews.*" — Holotypus, collected in 1877, GH! isotypus, NY! — *Parosela polydenia* var. *subnuda* (Wats.) Parish, Bot. Gaz. **55**: 305. 1913. *Psorothamnus subnudus* (Wats.) Rydb., N. Amer. Fl. **24**: 46. 1919.

Typical *Ps. polydenius* varies in stature, the adult plant taking the form of a depressed dome of stiffly enlaced branchlets or, in favorable conditions, that of a definite bush or shrub with one or more softly woody trunks. The only notable variation in detail is that, often noticed, in vesture of the calyx, which may be either pubescent from base upward or externally glabrous below the pilosulous teeth. The form with glabrate, vernicose calyx-tube has been collected repeatedly in Owen's Valley, California, near Independence, Laws, and Bishop in Inyo County, and near Benton in southern Mono County, and seems where present to exclude the pubescent form. This, however, occurs in the same region, near Deep Springs and Eureka Valley, as well as in immediately adjoining Esmeralda County, Nevada and on the central Mohave Desert. Exactly parallel variants are known in *Ps. schottii* and the quite local *Ps. thompsonae*, in both cases geographically localized but not displacing the commoner, more pubescent type. All are interpreted here as minor variants of no taxonomic consequence.

8b. PSOROTHAMNUS POLYDENIUS (Torrey) Rydberg var. JONESII Barneby (Plate VII)

Closely resembling var. *polydenius* but leafier, the leaves larger, up to 2.7 cm long, the 4–5 pairs of obovate leaflets subappressed-silky and 1.5–4.5 mm long; *calyx* pilosulous throughout with weak spreading hairs up to 0.5–1 mm long; otherwise as in key. — Collections: 2 (o).

Habitat not recorded, but to be sought on alkaline bluffs or flats along the immediate banks of Green River, known only from two (possibly all one) stations in Emery County, Utah. — Flowering mid-May to July. — *Material*: UTAH. Emery: Green River (typus); Robber's Roost s. of Green River, *Garrett 5934* (UC).

Psorothamnus polydenius (Torr. ex Wats.) Rydb. var. **jonesii** (Marcus Eugene Jones, 1852–1934) Barneby, nom. et stat. nov. *Dalea nummularia* (with round leaflets like pennies) Jones, Contrib. West. Bot. **18**: 41. 1933, pro parte, quoad lectotypum. — "Green River Utah, May 28 1914 P. coll. No. 28257 and Willow Spr. Ariz., June 11 1890, Jones." — Lectotypus, *Jones* from Green River, ticketed "Type" in Jones's hand, POM! isotypi, NY (2 sheets), POM, US! — The paratypus from Arizona = *Errazurizia rotundata* (Woot.) Barneby.

The type-collection of var. *jonesii* was identified by Morton (Contrib. U. S. Nat. Herb. **29**: 102. 1945) as *Dalea polydenia* or a variety of it. I think it may with justice be regarded as the latter, the loose spikes, larger leaves, and elongate bracts and calyx-teeth being substantially different from known forms of var. *polydenius*, and the dispersal dramatically disjunct. The protologue of *Dalea nummularia* was based on a mixture, the bracts and flowers being described from the Green River plant, the leaves and large pods from specimens of *Errazurizia rotundata*. The epithet *nummularia* refers to the little coinlike leaflets of the errazurizia and is quite out of place in the present context; reduction in rank permits a welcome change of epithet.

9. PSOROTHAMNUS THOMPSONAE (Vail) Welsh & Atwood
(Plate VII)

Small freely branching, lavishly floriferous shrubs of rounded or depressed-rounded outline, 4–9 (15) dm tall and often as much in diameter, rather softly woody but the short sterile branchlets immediately below the inflorescences tapering into vulnerant, often divaricately bifurcate, persistent spines, the stems densely silky-pilosulous with narrowly descending (retrorse) hairs up to 0.2–0.4 mm long and pustulate with prominent orange blister- or prickle-shaped glands, the foliage more thinly strigulose-pilosulous than the canescent stems, commonly greenish, the leaflets usually more densely pubescent above than beneath, the lower face paucipunctate; *leaf-spurs* up to 0.6 mm long; *stipules* triangular, 0.2–0.9 mm long, deciduous, charged at apex and often on margins with 1–3 glands; *leaves* short-petioled, (1) 1.4–3 cm long, with narrowly margined, punctate rachis and 3–8 (9) pairs of obovate to linear-oblanceolate, obtuse to emarginate, flat or loosely folded, thick-textured leaflets 2–7 mm long; *peduncles* terminal to branchlets, 0.5–1.5 cm long; *racemes* loose and open, the flowers spreading at full anthesis, the glabrous or puberulent axis becoming (1) 2–9 cm long; *bracts* early deciduous, ovate-elliptic, submembranous, 0.6–1.5 mm long, gland-tipped; *pedicels* spreading-ascending, 0.7–1.4 mm long, charged near apex with a pair of orange glands; *calyx* 3.7–5 mm long, either pilosulous throughout with spreading hairs up to 0.3–0.5 mm long or glabrous up to the margins of the ciliolate, internally silky-pubescent calyx-teeth, the tube 2.4–3.3 mm long (measured to lateral sinus), the dorsal sinus shallower than the rest and the orifice hence oblique, the ribs prominent but not cordlike, the firm, pleated intervals charged above middle with 1–4 large red-orange glands, the teeth ovate to oblong-ovate, obtuse to subacute, gland-mucronulate, herbaceous, obscurely 3-nerved below apex, very unequal, the ventral pair nearly twice as broad and longer than the rest, 1.1–2.3 mm long; *petals* bright pink- or violet-purple,

marcescent, glabrous, all glandless or the banner sometimes charged on back with a subapical gland; *banner* (5.5) 6–8.4 mm long, the claw (1.8) 2.2–2.5 mm, the ovate, basally broadly cuneate or cordate, sometimes suborbicular-cordate, notched blade (4.4) 4.8–6.2 mm long, (4.2) 4.8–6 mm wide; *wings* 7.6–8.6 mm long, the claw 2–2.7 mm, the oblong obtuse blade 5.8–6.6 mm long, 2.6–3.2 mm wide; *keel* (only a trifle longer than wings) 7.4–9 mm long, the claws (1.9) 2.1–3.2 mm, the broadly obovate blades 5.6–6.7 mm long, 3.4–3.8 mm wide; *androecium* 10-merous, 6–7.7 mm long, the longer filaments free for 2.5–3.5 mm, the connective gland-tipped, the anthers 0.8–0.9 mm long; *pod* 4–4.5 mm long, compressed, membranous and glabrous at base, thence firm, rugulose, pilosulous, gross-glandular; *ovules* 2 (3); *seed* 1, 2.1–2.6 mm long.

A highly decorative small shrub endemic to the canyonlands of southeastern Utah and adjoining Arizona, notable for the retrorse pubescence of the stems, the transformation of branchlets related to the inflorescence into stout vulnerant thorns, the open racemes of vivid pink-purple flowers, and the marcescence of the petals around the forming pod. Its open raceme and glabrous petals recall members of sec. *Xylodalea*, but the orange-pustular, retrorsely canescent-hairy stems and the spathaceous calyx are more nearly matched by *Ps. scoparius* and *Ps. polydenius* collectively. The species seems most nearly related to the latter, differing in the laxer raceme of larger flowers and in the broad, ovate or oblong-ovate calyx-lobes.

Since Kearney & Peebles described *Dalea whitingi*, its sister species *D. thompsonae* has become much better known, and the variation within it nearly spans the discontinuity between the two. Typical *Ps. thompsonae* may have a calyx externally either glabrous or pubescent, and the differences between it and *Dalea whitingi* are reduced to shape of leaflets, these relatively broad and small in var. *thompsonae*, narrower and longer (but not necessarily fewer) in what must be called var. *whitingi*. The two varieties occur in the same environment and are clearly no more than vicariant races of one strongly characterized and isolated species.

Key to the Varieties of *Psorothamnus thompsonae*

1. Leaflets (7–13) obovate to broadly oblanceolate, 2–4 (5) mm long; *calyx* commonly glabrous externally below margins of the teeth, more rarely pubescent from base upward; centr. Wayne, e. Garfield, and adjoining San Juan counties, Utah. 9a. var. *thompsonae*.
1. Leaflets (7–17, rarely 19) linear-oblanceolate to linear-oblong, 3–7 mm long; *calyx-tube* pilosulous externally from base upward; s.-e. San Juan County, Utah, and Coconino County, Arizona. 9b. var. *whitingi*.

9a. Psorothamnus thompsonae (Vail) Welsh & Atwood var. thompsonae (Plate VII)

Characters as given in key; *leaflets* never decurrent. — Collections: 13 (iii).

Hummocked dunes and dunelike or bouldery talus slopes under cliffs, sometimes colonial along sandy and gravelly washes of the canyon floor, confined to red and white sandstones, 1080–1410 m (3600–4700 ft), locally abundant but of highly restricted range in low valleys and canyons leading to the Colorado River in e.-centr. Wayne, e. Garfield, and lower reaches of White Canyon in adjoining San Juan coun-

ties, Utah. — Flowering late May to July. — *Representative*: UTAH. Wayne: *McVaugh 14,611* (NY); *Holmgren et al. 10,944* (UC). Garfield: *Barneby 15,021* (CAS, NY); *Maguire 10,608, 10,609* (NY, UC); *Cronquist 9046* (NY, and widely distributed). San Juan: *Barneby 13,083* (CAS, NY), *15,014.*

Psorothamnus thompsonae (Vail) Welsh & Atwood, Great Basin Nat. **35**(4): 354. 1975, based on *Parosela thompsonae* (Ellen Powell Thompson) Vail, Bull. Torrey Club **24**: 18. 1897. — "Original locality, Northern Arizona. Type collected by Mrs. Thompson, 1872." — Holotypus, collected probably, like some others gathered by Mrs. Thompson and Capt. Bishop on Powell's Grand Canyon Expedition, in southeastern Utah, US! isotypus (fragm), NY! — *Dalea thompsonae* (Vail) L. O. Wms., Ann. Missouri Bot. Gard. **23**: 451. 1936; Tidest. in Tidest. & Kitt., Fl. Ariz. & New Mex. 181. 1941.

This is one of the most colorful small desert shrubs of its region, the low prickly mounds of twigs and foliage disappearing in May beneath a cloud of vivid pink-purple flowers. The whole plant is strongly scented when crushed, the orange or red glands of the stems yielding an aromatic resinous oil. Until recent years *Ps. thompsonae* was little known, its range lying in a corner of Utah only lately opened to easy access. Rydberg knew the species only from the type, and failed to notice the insertion of all petals on the hypanthium rim, in consequence accepting it as *Parosela*, despite its generic characters of *Psorothamnus*. The known range of var. *thompsonae* extends from a point about ten miles south of Hanksville southeast across the east foothills of the Henry Mountains to Hite, there passing to the east bank of the Colorado River in the lower reaches of White Canyon, a total airline distance of less than 40 miles. It may, of course, recur lower down the Colorado, possibly in Arizona, as suggested in the protologue, but this awaits confirmation in the form of specimens.

9b. PSOROTHAMNUS THOMPSONAE (Vail) Welsh & Atwood var. WHITINGI (Kearney & Peebles) Barneby

(Plate VII)

Characters as given in key; *leaflets* sometimes decurrent on the rachis. — Collections: 5 (o).

Sandy clay banks and talus in canyons, on red sandstone, below 1500 m (5000 ft), forming colonies but very local, known only from two widely separated stations: Copper Canyon, a wash descending n.-w. from Monument Valley to the San Juan River in San Juan County, Utah; on banks of Little Colorado River within Wupatki National Monument, Coconino County, Arizona. — Flowering June to August. — *Material*: UTAH. San Juan: *Cutler 2265* (NY, WIS, UC, US). ARIZONA. Coconino: *D. Jones 84/1939* (NY, UC); *Beasley 885* (CAS, NY, US,), *886* (NY).

Psorothamnus thompsonae (Vail) var. **whitingi** (Kearn. & Peeb.) Barneby, stat. nov., based on *Dalea whitingi* (Alfred Frank Whiting, 1912–) Kearn. & Peeb., Jour. Wash. Acad. Sci. **29**: 484. 1939. — "Type: *Whiting & Jones* 916/3277, Wupatki National Monument on Little Colorado River, Coconino County, Ariz., August 9, 1938..." — Holotypus, US!

On present evidence this is an extraordinarily rare shrub, though hardly more so than *Errazurizia rotundata* or *Psorothamnus arborescens* var. *pubescens*, which are also endemic to the same general area of the Colorado Canyonlands. It seems probable that other populations will eventually be discovered, as the maze of box canyons leading to the Colorado river are more fully explored. According to June Beasley, who kindly undertook to collect material at the type-locality, downstream from Black Falls on Little Colorado River, the plants are locally plentiful there on a particular bench along the river. Cutler also described the plants as locally abundant in Copper Canyon.

III. MARINA Liebmann

Monocarpic and perennial herbs or shrubs, pubescent with straight or curly but neither spirally twisted nor (when dry) rufescent hairs; *leaves* imparipinnate, rarely reduced to the terminal leaflet, the margined rachis produced beyond the last pair of leaflets, the odd one therefore stalked; *blades* of leaflets marked by pallid, sinuously ascending lineoles, gland-sprinkled dorsally, often gland-crenulate; *glands* behind each petiolule and one gland between each pair of petiolules; *racemes* moderately dense to loose and open, never capitate nor conelike, borne on terminal and apparently leaf-opposed peduncles; *pedicels* always present, sometimes short, subtended by a pair of glands and charged above the middle with another pair; *bracts* small, ± embracing the young flower-buds, deciduous or rarely marcescent; *calyx* campanulate, 5-toothed, the tube 10-ribbed, the ribs leading to the teeth simple, those leading to the sinuses Y-shaped, all disappearing into the plane, herbaceous blade of the tooth and not anastomosing into closed arches; *intervals* between the calyx-ribs mostly thin-textured, charged with one vertical row of glands, these sometimes few, or immersed, or rarely confluent; *banner* (usually shorter than the detached keel) inserted on rim of the andreocial cup, composed of a slender, wing-margined claw and a variably recurved and variably shaped blade, this often peltate and recessed behind top of claw into a sunken cornet; *wings* and *keel* elevated on a column continuous with the staminal tube, the keel nearly always longer than the wings, the outer edges of its blades narrowly overlapping and adherent by their faces, rarely free; *androecium* monadelphous, mostly 10-, rarely 9-, in one species 5-merous; *style* glabrous distally, the stigma punctiform; *ovule* 1; *pods* of 3 types: a) compressed and harp-shaped in profile; b) obliquely obovoid and compressed; c) plumply obovoid, nutlike, little compressed, the valves in a) and b) forming a cavity larger than the seed and charged on each face with blister-glands arranged in ± definite crescentic patterns, in c) closely investing and adherent to the seed and pustulate with scattered or crowded glands arranged in no obvious pattern; *seed* small, mostly 1.3–2 mm long, smooth, lustrous; $x = 10$. — Species 38, of subtropical and arid tropical, desert, and dry winter climates, all native and most endemic to Mexico, 3 spp. extending into extreme s.-w. United States (New Mexico to transmontane s. California), 3 into the highlands of Guatemala, and one of these widespread as a weed through central America, apparently adventive in n. Venezuela and Cuba; almost lacking on the Mexican Plateau, poorly represented in Sierra Madre Oriental, highly diversified and abundant in the Balsas Depression, in arid central Oaxaca, through the Sierras Madre Sur and Occidental, and on the Sonoran Desert and Cape region of Baja California.

Marina (in honor of Marina or Malinche, the cacique's daughter who interpreted for Hernán Cortés during the conquest of Mexico) Liebm., Vidensk. Meddel. **1853**: 103. 1853. — Generitypus: *M. gracilis* Liebm.

The genus *Marina* is closely related to *Dalea*, sens. restr., and has traditionally been included in it. It is in these two genera alone that the inner pairs of petals have migrated out from the hypanthium rim onto a columnar disc and appear to perch, as it were, on the staminal sheath. This strikingly peculiar character has overshadowed the differences between them, which are not only several but beautifully correlated. In *Dalea*, as defined below, the ovules are always two and collateral; and disregarding one small group of species, not otherwise resembling any *Marina*, in which Mosquin has found eight pairs of chromosomes, the basic chromosome number is so far as known always seven. In *Marina* there is but one ovule; and the basic chromosome number is ten. The trichomes of *Dalea*, when present, are flexuous and, when long, spirally twisted; with rare exceptions the pubes-

cence, always white or silvery when fresh, turns rusty or yellowish when dry. The hairs of *Marina* are relatively stiff, always short, never spiral, and unchanged by drying. The surface of the *Dalea* leaflet is uniformly green (beneath the vesture, if present), or may be minutely pallid-dotted, but the dots never run together into linear patterns. In *Marina* both faces of the leaflet are marked with fine sinuous lineoles, pallid against a green field, which ascend at a more or less acute angle from near the midrib toward the margin. The calyx-ribs of almost all genuine *Daleae* anastomose in the teeth and are produced beyond the triangular or deltate base of the tooth into a distinct point, often prolonged into a subulate or setiform tip. In *Marina* the ribs take the form of alternate I and Y, but the branches of the Ys peter out into the plane herbaceous blade of the calyx-tooth and fail to anastomose with the adjacent Is to form the gallery of closed Gothic arches characteristic of *Dalea*. The two genera are alike in having one gland situated behind each petiolule along the leaf-rachis (these exceptionally impressed or obsolete in both); but while in *Dalea* there are (nearly always) a pair of glands or spicules situated between the petiolules ventrally, in *Marina* there is but one. Reduction of the glands in some species of each genus render this character negative in a few individual cases, but when present it is decisive. The array of differential characters found in foliage, flower, and caryotype enable one to recognize a *Marina* at any stage of growth.

The flower of *Marina* is always pedicelled, but this is not a diagnostic character, for several genuine *Daleae*, while unlike *Marina* in other characters, have racemose and not the more usual spicate inflorescence. Pedicelled flowers are shared by the genera *Marina* and *Psorothamnus*, which are further alike in their plane, herbaceous calyx-teeth and, so far as known, in the basic chromosome number of ten. The inner petals of *Psorothamnus*, however, are inserted on the hypanthium rim and the ovary contains at least two collateral ovules, sometimes an additional one or two pairs. The leaflets of *Psorothamnus* lack the lineoles found in *Marina*, and there are no intrapetiolular glands or spicules. In both these genera the blades of the keel overlap in vernation and adhere by their faces. In almost all groups of *Dalea* where the keel-petals are united at anthesis, the union of the blades is by their exterior edges (valvate not imbricate). The relationship of *Marina* to *Psorothamnus* is obviously a close one, perhaps closer than to *Dalea* sens. restr.

Two main divisions of *Marina* are defined below in the rank of section. The much greater, sect. *Marina*, which has two primary centers of speciation, one around the Gulf of California, the other in the Balsas Depression in southern Mexico, is characterized by a compressed pod, obliquely obovate, half-circular, or harp-shaped in profile, with terminal but often strongly eccentric style-base and a cavity substantially larger than the seed. The glands on the faces of the pod are here arranged, except in the anomalous *M. gemmea*, in transverse or obliquely descending crescentic patterns. The section consists of three main series and three ancillary monotypic ones: the large ser. *Chrysorrhizae*, concentrated around the Gulf of California, with mostly short, firm pedicels, a pubescent calyx, and gland-sprinkled banner; the smaller ser. *Unifoliolatae*, ranging through southern Mexico to Guatemala, and differing in capillary pedicels and glandless banner, generally associated with a reduced number of leaflets; the ser. *Crenulatae*, centering in Jalisco, with many leaflets, capillary pedicels, and gland-sprinkled banner, but totally glabrous, thus essentially like sect. *Carroa* except for the compressed pod; and ser. *Gemmeae, Marina*, and *Vetulae,* each of one highly specialized species, the two first probably derived from ser. *Unifoliolatae*, the third from ser. *Chrysorrhizae*. The sect. *Carroa*, dispersed over the whole range of the genus except that it is absent from Baja California, has a nutlike pod much less strongly compressed than that of sect. *Marina*, commonly subglobose or pyriform, with lateral style-base and valves closely investing and finally adherent to the seed. The pod's valves are charged with blister-glands arranged in no obvious pattern and are as a rule uniformly pustulate over the whole surface.

The ser. *Chrysorrhizae*, ser. *Crenulatae*, and sect. *Carroa* each present a series of life-forms ranging from shrub to herb, and count among their herbaceous members both perennial and monocarpic species. The remaining series within sect. *Marina* consist of herbs only, among which obligate annuals preponderate. The species of short duration appear always more highly specialized in the context of their group, and it is clear that the monocarpic condition is the terminus of several parallel evolutionary paths.

Since its description in 1853 *Marina* has been maintained distinct from *Dalea* (or *Parosela*) only by Hutchinson (1964, p. 419) who, however, misinterpreted the flower and referred the genus to his tribe *Psoraleeae* as though it had petals inserted on the hypanthium rim and not elevated on the staminal column. The close affinity of the generitype, *M. gracilis*, independently described as *Parosela delicata* Rose, to several annual, uniovulate paroselas found in southern Mexico was perceived by Rydberg (1919, p. 51) who treated it as forming by itself a group *Delicatae*, distinguished from *Chrysorrhizae* by its sharply dentate calyx-teeth. While certainly a strongly marked species, *M. gracilis* is unquestionably congeneric with *M. holwayi* and some others each in its own way uniquely modified.

An earlier name for *Marina* as defined in these pages is *Trichopodium* C. K. Presl (1844), unfortunately a later homonym. The generitype of *Trichopodium* is one of the totally glabrous species with capillary pedicels and nutlike pods that formed part of *Parosela* sect. *Diffusae* Rydb. Rydberg (1919, p. 49) treated *Trichopodium* as a subgenus of *Parosela* which included *Marina* and was supposed to differ from genuine *Parosela* in having flowers at once pedicelled and reflexed at anthesis. As already noted, this is not a practical diagnostic character. However, *Trichopodium* sensu Rydberg, if shorn of its sects. *Lasiostomae* and *Lachnostachyae*, which have pedicellate flowers but all other characters of *Dalea*, is equivalent of *Marina* sensu latiori of this account. Because the name *Trichopodium* was applied to an unnatural concept by Rydberg and thus became ambiguous in its application I have taken up, for the small sectional group of *Marina* which includes the original *T. glandulosum* Presl, the name *Carroa* Presl (1858, pro gen., substituted for *Trichopodium* Presl non Lindl.).

Division of the genus into two sections characterized by a fruiting character, while theoretically satisfactory, raises a difficulty in practice. The majority of perennial and shrubby marinas flower in fall and winter, and their pods ripen slowly, often not until all flowers are past anthesis. At this stage of growth the plants are inconspicuous and rarely collected. The identity of the average specimen, which is likely to bear flowers but at best quite unripe pods, could not be determined by means of a key based on the fundamental sectional characters. As an alternative to an ideal systematic key, I present a synopsis of the genus which stresses fundamental characters but ignores uncommon exceptions. Following this will be found a pragmatic key to the species based primarily on more easily observed, specific rather than sectional characters.

Synopsis of the Sections and Series of *Marina*

1. Pod laterally compressed, obovate or harp-shaped in profile view, its valves loosely investing the seed and charged on each face with blister-glands arranged in 2 obliquely ascending or 1 ascending and 1 (distal) transverse crescentic arcs (pustulate all over in monotypic ser. *Gemmeae*); *style-base* terminal to the pod but often strongly eccentric. A. sect. **Marina** (p. 66)
   2. Plant ± pubescent, but if the leaves and stems glabrous at least a remnant of pubescence around and within the orifice of the calyx, or the ribs of the calyx pectinately ciliolate.
      3. Calyx-teeth gland-sprinkled dorsally; *valves of pod* densely glandular-pustulate over whole surface (1 sp.). iii. ser. *Gemmeae* (p. 96)

3. Calyx-teeth often gland-spurred marginally but not glandular dorsally; *valves of pod* charged with glands arranged in crescentic patterns.
   4. Banner (and usually keel-blades) gland-sprinkled; *pedicels* relatively short and firm, not capillary; w. Mexico and s.-w. United States, most abundant around Gulf of California, 1 sp. in s. Mexico.
      5. Dorsal tooth of calyx not over twice as long as tube; *keel-petals* (detached from column) nearly as long to much longer than banner, their blades overlapping along external margins and adherent by their faces (if exceptionally free then the androecium 5-6-merous); *terminal leaflet* sometimes larger than the last pair but little different in shape (17 spp.). i. ser. *Chrysorrhizae* (p. 66)
      5. Dorsal tooth (like the rest) ± 4 times as long as the shallow tube; *keel-petals* only ½-⅔ as long as banner, free even in the bud; *terminal leaflet* lanceolate, 2-3 times as long as the last pair, the lateral pairs all suborbicular (1 annual sp., Baja California). ii. ser. *Vetulae* (p. 94)
   4. Banner glandless; pedicels mostly capillary; s. Mexico and Guatemala.
      6. Calyx-teeth entire (but their margins often gland-spurred); *hairs* on ribs of calyx mostly forwardly incurved or subappressed; plants either annual or short-lived perennial (6 spp.). iv. ser. *Unifoliolatae* (p. 98)
      6. Calyx-teeth sharply toothed; *hairs* on ribs of calyx straight, ascending; annual (1 sp.). v. ser. *Marina* (p. 108)
2. Plant glabrous throughout. Pedicels mostly capillary; *banner and keel* gland-sprinkled; herbs and shrubs of s. and s.-w Mexico, extending along Sierras Madre del Sur and Occidental into Oaxaca and Sonora (4 spp.). vi. ser. *Crenulatae* (p. 110)

1. Pod little compressed, nutlike, subglobose or pyriform, its valves closely investing and adherent to the seed, charged on each face with glands (scattered or crowded) arranged in no apparent pattern; *style-base* terminal on the ovary but becoming lateral on the fruit; *plants* totally glabrous; range nearly of the genus, but absent from Baja California (8 spp.). **B.** sect **Carroa** (p. 119)

Key to the Species of *Marina*

1. Calyx ± pubescent, sometimes only around or within the orifice.
   2. Glands on calyx confined to a row in each interval between the ribs and the margins of the teeth; *faces of the pod* charged with glands arranged in 2 crescentic arcs; *sinus* between the ventral pair of calyx-teeth not (or scarcely) shallower than the lateral sinuses.
      3. Blade of banner gland sprinkled.
         4. Flowers and pod ascending from the raceme-axis (neither declined nor nodding).
            5. Blades of keel at least 2.4 mm long, adherent by their overlapping exterior edges to form a genuine carina and exserted well over 1 mm beyond the longest calyx-tooth.
               6. Stems pilosulous throughout, or at least at some upper nodes and distally, with relatively stiff, widely spreading or subretrorse hairs.

7. Annual or feebly perennant plants of the deserts of Baja California Sur, one extending across the Gulf to coastal dunes in Sonora and Sinaloa; *flower* small, the keel-blades 2.3–3.7 mm long, bright magenta-purple with pale outer edges; *glands* in each interval of the calyx 4–7, not concentrated above middle of tube.
   8. Leaflets and dorsally pilosulous calyx-teeth thin-textured, membranous, green (or green beneath cinereous vesture); *subterminal gland* on back of leaflets 0.1–0.2 mm long; *leaflets* mostly 4–8 pairs, obovate to oblong-obovate; *racemes* mostly (8) 10–25-flowered, the axis 1–2.5 cm long in fruit; *stems* pubescent their whole length; Baja California n.-ward from La Paz to coastal s. Sonora and centr. Sinaloa. 14. *M. peninsularis* (p. 88)
   8. Leaflets and dorsally glabrate calyx-teeth thick-textured, glaucescent; *subterminal gland* on back of leaflets 0.3–0.4 mm long; *leaflets* mostly 8–11 pairs, narrowly oblong-oblanceolate; *racemes* shortly but loosely 4–12-flowered, the axis up to 1 cm long in fruit; *stems* thinly pilosulous with erect hairs distally, glabrous or nearly so proximally; Cape region, s.-ward from La Paz. 16. *M. chrysorrhiza* (p. 91)
7. Perennial (diffuse or prostrate) plants of Sierra Madre piedmont in s.-e. Sonora and adjoining Sinaloa; *flower* larger, the keel-blades 4–4.3 mm long, pink-purple; *glands* in each interval of calyx 1–2 (3), concentrated above middle of tube or just below its orifice. 9. *M. goldmani* (p. 79)

6. Stems glabrous or pubescent, but if pubescent the vesture strigulose-pilosulous, the hairs subappressed or narrowly incurved-ascending (rarely subtomentulose), never widely divergent.
   9. Stems smooth or sparsely and remotely low-tuberculate distally, the more prominent glands lenslike and scarcely elevated; prostrate perennial or feebly suffrutescent plants of the Sierra Madre foothills in s. Sonora, Sinaloa, and adjoining Chihuahua and Durango, s.-ward from Río Mayo (and thus outside the Sonoran Desert).
      10. Main cauline leaves 2–6.5 cm long, with 9–24 pairs of leaflets; *bracts* persistent; *calyx-tube* 1.7–2.2 mm long, glabrous or nearly so, the intervals between the ribs firm, charged at or just below the orifice with 1–2 brown blister-glands; *keel-blades* 5–5.4 mm long; centr. Sinaloa and adjoining Durango. 8. *M. minor* (p. 78)
      10. Main cauline leaves 1–3.5 cm long, with 7–12 (14) pairs of leaflets; *bracts* deciduous, at least by late anthesis; *calyx-tube* 1.2–1.6 mm long, densely pilosulous, the intervals membranous, charged at and near the middle with ± 3 small, yellowish glands; *keel-blades* 3–3.8 mm long; s.-e. Sonora and adjoining Chihuahua, in and near the Río Mayo drainage. 10. *M. alamosana* (p. 81)
   9. Stems prominently and usually densely glandular-verruculose, the more prominent glands nearly always high-convex or grainlike; mostly of the Sonoran Desert, extending (very

abundantly and critically) through s. peninsular Baja California to the Cape, one (*M. Palmeri*) sympatric with the last.

11. Range entirely s. of the Sonoran Desert, extending from s.-e. Sonora into Sinaloa; suffruticose perennials, with very small flowers, the calyx 2.2–2.7 mm, the keel-blades 2.9–3.2 mm long. 6. *M. palmeri* (p. 75)

11. Range entirely within the Sonoran Desert and Cape region of Baja California Sur; if the flower as small then the stem entirely herbaceous.

12. Flower small, the calyx 2.1–2.8 mm, the keel-blades 2.3–3.7 mm long; local sp. of extreme s. Baja California, around La Paz and Todos Santos.

13. Leaflets 4–8 pairs; slender annuals with flexuously radiating stems; *racemes* mostly 1–2.5 cm long; vicinity of La Paz. 15. *M. interstes* (p. 89)

13. Leaflets 11–18 pairs; annual or perhaps perennant, but the stems stiff and wiry; *racemes* mostly 2.5–4.5 cm long; vicinity of Todos Santos. 7. *M. capensis* (p. 76)

12. Flower larger, the calyx at least 3 mm, the keel-blades mostly at least 4 mm long, substantially larger in the range of the preceding.

14. Flower of moderate size, the keel-blades mostly 3.7–5 mm long; *petals* bicolored, the inner ones usually bright blue or purple in inner half, pale in outer half (if concolorous the leaflets not over 9 pairs); widespread over the Sonoran Desert and Gulf islands, and in Baja California through the Cape mountains to Cabo San Lucas.

15. Intervals between the calyx-ribs charged from base to summit with a chain of (4) 5–6 small glands; *plants* mostly herbaceous, becoming feebly suffrutescent in age; *ovary* and pod pubescent; Arizona and s.-e. California to Sonora, and s. through Baja California as far as the Viscaíno Desert and region of La Paz, the common *Marina* over most of the Sonoran Desert. 1. *M. parryi* (p. 66)

15. Intervals between the calyx-ribs charged only above middle of tube with (1) 2–3 glands; *plants* frutescent at maturity, but flowering precociously; *ovary* and pod glabrous or nearly so; Baja California Sur, along the Pacific side of the peninsula s.-ward from Magdalena Bay and s. through the Cape region from La Paz.

16. Stems mostly glabrous and glaucescent-pruinose, only some young branchlets sometimes thinly hirsutulous; *calyx* glabrous externally; *leaflets* glabrous to hirsutulous dorsally; *plants* of rocky shores,

stony and sandy desert washes, ascending into pine-oak forest on the Cape mountains, but not found on sea dunes.
2. *M. divaricata* (p. 69)

16. Stems densely strigulose or tomentulose, white or cinereous; *calyx* pubescent externally, at least beyond middle; *leaflets* strigulose-hirsutulous on both sides; *plants* weakly soft-woody, sprawling, found on dunes and washes opening on the sea, local about La Paz and s.-ward around the Cape. 3. *M. maritima* (p. 72)

14. Flower large, the keel-blades 5–7 mm long; *petals* (except for pale, gland-sprinkled eye-spot of banner) all vivid blue, the wings and keel not pale along their outer edges; leaflets of larger cauline leaves over 12 pairs; rare spp. endemic to islands (Santa Catalina, Cerralvo) off the Gulf coast of Baja California Sur.
17. Calyx glabrous except for the thinly ciliolate orifice; *leaflets* of relatively thin texture, 3–11 mm long; *young branchlets* canescently strigulose; Isla Cerralvo. 4. *M. oculata* (p. 73)
17. Calyx pilosulous from base upward; *leaflets* carnosulous, 1–2.2 mm long; *young branchlets* glabrous; Isla Santa Catalina.
5. *M. catalinae* (p. 74)

5. Blades of the keel-petals 1.1–2 mm long, included within the calyx or exserted at most 0.5 mm beyond longest calyx-tooth, not adherent to one another in the form of a carina but free even in bud, caducous at anthesis; annual or weakly biennial plants of the Sonoran and Chihuahuan deserts.
18. Stems and leaves strigulose like the spikes, the vesture of calyx and leaflets similar in quality; *leaflets* 3–7 pairs, thin-textured, up to 3–7 mm long, obviously longer than wide, the terminal one little larger than the last pair; *bracts* tardily deciduous; *calyx* 3–3.7 mm long, its teeth shorter than or subequal to the tube; *androecium* 5-merous; centr. Baja California and near Guaymas, Sonora. 17. *M. evanescens* (p. 92)
18. Stems and leaves glabrous, contrasting with densely pilose spikes; *leaflets* 10–22 pairs, carnosulous, glaucescent, the lateral pairs suborbicular, ± 1–2.5 mm diam, the terminal one lanceolate and 2–3 times as long as the last pair; *bracts* early deciduous; *calyx* 4.3–5 mm long, its teeth 2–3 times as long as the shallow tube; *androecium* (9) 10-merous; central Baja California and Isla Tiburón; Coahuila. 18. *M. vetula* (p. 95)

4. Flowers and pods early declined or nodding.
19. Plants glabrous up to the pectinately ciliolate calyx; *petals* vivid magenta-purple or -violet; s. Mexico (Jalisco s.- and e.-ward to Oaxaca); *stems* assurgent; var. *neglecta* of: 27. *M. neglecta* (p. 110)
19. Stems and leaves variably pubescent; *petals* rose-purple or bicolored (the keel striped lengthwise); *if* sympatric with the last *then stems* pliantly humifuse.

20. Plants of s. and s.-e. Mexico (Jalisco to Chiapas); *stems* pliantly humifuse, arising from a superficial root-crown, hirsutulous with spreading hairs and (at least distally) prominently gland-tuberculate; *hairs* on calyx incurved. 13. *M. procumbens* (p. 86)

20. Plants of s.-w. United States and n.-w. Mexico (Chihuahua, Sonora, Baja California); *stems* procumbent or incurved, arising from shallowly buried root-crown, strigulose with appressed or narrowly ascending hairs, eglandular or nearly so (glands, if present, minute and impressed); *hairs* on calyx straight, ascending.

21. Calyx at anthesis 4.2–5 mm long, hirsutulous with hairs up to 0.3–0.6 mm long; *blades* of keel 3.6–4.1 mm long; *post-petiolular glands* small but visible, sometimes prominent; *leaflets* charged beneath around the margins with a row of glands; local in Baja California (from Sierra Juárez s. to Sierra de las Palmas, ± 27° 15′–32° 15′ N) and s. California (Sta. Rosa Mts.). 12. *M. orcuttii* (p. 84)

21. Calyx at anthesis 5.2–7 mm long, silvery-hirsutulous with hairs up to 0.65–1.1 mm long; *blades* of keel 4.3–5.8 mm long; *post-petiolular glands* 0; *leaflets* eglandular dorsally; s.-e. Arizona and adjoining New Mexico to n. Sonora and centr. Chihuahua. 11. *M. calycosa* (p. 82)

3. Blade of banner glandless; plants of s. Mexico and Guatemala.

22. Raceme subumbellate, 3–8 (11)-flowered, the axis 1–7 mm long; *stems* flexuously procumbent or diffuse, mat-forming, flowering precociously, but *root* not obligately monocarpic. Leaflets 7–11 pairs; *keel-blades* ± 3–3.5 mm long. 20. *M. holwayi* (p. 98)

22. Raceme ± elongate, the axis well over 1 cm long in more vigorous inflorescences; *stems* mostly erect, if diffuse then wiry; *obligately monocarpic*.

23. Leaflets 5–many in all leaves, varying from narrowly oblanceolate to obovate.

24. Racemes mostly over 10-flowered (only depauperate subterminal ones less than 10-flowered); *calyx* mostly less than 4.5 mm long, its teeth entire, the ribs pectinately ciliolate with antrorsely incurved hairs or glabrous.

25. Racemes relatively dense, spiciform, the flowers and fruiting calyces subcontiguous; *calyx-tube* glabrous, the teeth minutely pilosulous. 23. *M. spiciformis* (p. 103)

25. Racemes lax and open, the flowers separated by intervals as wide as each calyx or wider; *calyx-ribs* pectinately ciliolate.

26. Flower relatively large, the calyx 4.3–5 mm, the keel-blades 4.7–5 mm long; *androecium* 10-merous, the longest filament 7–8 mm long, free for ± 2 mm; *bracts* deciduous from the swelling flower-buds; *plants* 4–8 dm tall. 21. *M. melilotina* (p. 101)

26. Flower small, the calyx 3–3.7 mm, the keel-blades 1.8–2.4 mm long; *androecium* 9-merous, the longest filament ± 3–4 mm long, free for 0.8–1 mm; *bracts* persistent, becoming brown and glumaceous; *plants* 1–5 (6) dm tall. 22. *M. pueblensis* (p. 102)

24. Racemes loosely or remotely 2–7-flowered; *calyx* at anthesis at least 4.5 mm long, a little accrescent in age, its teeth sharply and prominently toothed, its ribs pilosulous with straight, ascending, lustrous hairs. 26. *M. gracilis* (p. 108)

23. Leaflets solitary, or some upper leaves rarely 3-foliolate, the leaflets in any case suborbicular to broader than long.

27. Calyx (pectinately ciliolate on ribs) 3–4 mm long, the teeth lanceolate, 1.5–2.3 mm long, the ventral pair united for nearly half their length; *petals* relatively large, the banner 2.2–3 mm, the keel-blades 2.9–3.7 mm long; *androecium* 10-merous, the longest filament 4.3–5.5 mm long, at least slightly longer than calyx, the anthers 0.35–0.5 mm long; Guerrero and s.-w. México to Jalisco. 24. *M. unifoliolata* (p. 104)

27. Calyx (either pectinately ciliolate or glabrate) 2.2–2.5 mm long, the teeth ovate, 0.8–1.2 mm long, the ventral pair united scarcely higher than the lateral ones; *petals* small, the banner 1.6–1.9 mm, the keel-blades 1.5–1.7 mm long; *androecium* (7) 9-merous, the longest filament 2.2–3 mm long, curved and thus not exserted from calyx, the anthers 0.2–0.3 mm long; s. México to Puebla and Oaxaca. 25. *M. greenmaniana* (p. 106)

2. Glands on calyx not only intercostal and marginal to the calyx-teeth but also on backs of calyx-teeth; *faces of the pod* charged all over with crowded blister-glands; *sinus* between the ventral pair of calyx-teeth about half as deep as the lateral sinuses; plants of arid grassland in w. arm of Balsas Depression, in s.-w. Michoacán. 19. *M. gemmea* (p. 97)

1. Calyx, like the entire plant, glabrous (if leaves 1-foliolate cf. 25. *M. Greenmaniana*).

28. Blade of the banner peltate, the basal lobes united across the top of the claw by a wing- or ridge-like projection enclosing a recessed cornet. Pod various; *racemes* either few- or many-flowered.

29. Leaflets of main cauline leaves 4–7 (8) pairs; *racemes* openly many-flowered, the axis mostly 4–16 cm long; *plants* perennial, herbaceous; var. *elongata* of. 27. *M. neglecta* (p. 110)

29. Leaflets of main cauline leaves (caveat: not present on all specimens, especially of shrubby spp.) more numerous, or flowers fewer and racemes shorter, one of these characters apparent if the plant herbaceous and perennial.

30. Raceme very shortly or subumbellately 2–6-flowered, the axis not over 3 mm long; *main stems* prostrate or diffuse, herbaceous, the racemes borne terminal to delicate, leafy, axillary branchlets; local in Jalisco (vicinity of Guadalajara). 34. *M. gracillima* (p. 127)

30. Raceme few- or many-flowered, but if flowers only 2–6 then openly racemose, the axis much longer, the racemes borne in finely ramified panicles terminal to *erect woody stems.*

31. Flower small, the calyx 2–3 mm long, the keel-blades 1.8–3.2 (3.4) mm long, the androecium ± 3.5–5 mm long; *slender annual herbs* up to 6 (7) dm tall, the root usually present in herbarium specimens.

32. Blade of banner suborbicular, shallowly emarginate, eglandular; *pod* densely glandular-bullate, the surface of each face charged with ± 20–30 subcontiguous glands up to 0.05–0.25 mm diam; *leaflets* of main cauline leaves commonly 8–12 pairs, rarely fewer; *racemes* mostly (1) 2–6

(9)-flowered, the flowers mutually remote; Morelos and adjoining Guerrero to Puebla and s.-centr. Oaxaca. 35. *M. minutiflora* (p. 129)

32. Blade of the banner spade-shaped, deeply retuse at apex, with a large subapical gland and several smaller ones in the eye; *pod* sparsely glandular, the surface of each face charged with ± 6–9 large and fragile glands well separated mutually and up to 0.2–0.4 mm diam; *leaflets* of main cauline leaves typically 6–8 (9) pairs, sometimes more numerous; *racemes* usually denser and 4–12-flowered; Morelos, s. México, and Michoacán. 36. *M. stilligera* (p. 130)

31. Flowers mostly larger, but if within the size-range of the above the plant shrubby and much taller.
    33. Stems (especially distally) charged with many small, elevated glands, obviously and usually densely micro-tuberculate; *valves* of the pod charged all over with subcontiguous blister-glands, appearing uniformly bullate.
        34. Flowers relatively large, the calyx over 3 mm, the keel-blades over 5 mm long; common and showy *perennial, scarcely suffrutescent herb* of the Transverse Volcanic Belt, extending n. along Sierra Madre Occidental to w. Durango, along Sierra Madre Oriental to Tamaulipas and extreme s. Nuevo León, s. sparingly to s. Guerrero and centr. Oaxaca. 31. *M. nutans* (p. 119)
        34. Flowers small, the calyx less than 3 mm, the keel-blades 3.3–4.3 mm long; *shrubby or at least suffruticose* plants, of Sierra Madre del Sur in Guerrero and Chiapas, to be expected in Oaxaca. 32. *M. ghiesbreghtii* (p. 122)
    33. Stems smooth, eglandular or nearly so, the glands when present minute, lenslike, scarcely elevated.
        35. Inflorescence a finely and repeatedly branched panicle of very slender or capillary branchlets and peduncles, the racemes openly or remotely 1–25-flowered, the flowers borne much further apart than the length of their pedicels; *calyx* 2.5–3.6 mm long, the tube not or scarcely pleated, with 2–5 glands in each interval, the dorsal tooth 0.7–1.6 mm long; *pod* turgidly nutlike, not obviously carinate across the top, the valves charged with small, mutually distant glands arranged in no obvious pattern, firm almost to the base, closely investing the seed; *shrubs* 1–2.5 m tall, with several ligneous main stems. 33. *M. diffusa* (p. 123)
        35. Inflorescence not as above, the racemes mostly terminal to short leafy branchlets, or if arranged in a few-branched terminal panicle then the flowers more crowded, borne at intervals along the rachis shorter than their pedicels (or if longer, the root annual); *if shrubby, the calyx-tube strongly pleated,* its intervals charged (nearly always) with a row of 7–12 or more small glands, and the dorsal tooth mostly 1.4–3 mm long; *pod* strongly compressed, carinate across the top, the valves charged on each side with a few glands ar-

ranged in two subvertical or one subvertical and a distal transverse crescent, hyaline at base, loosely investing the seed.

36. Slender annual herbs (of Nayarit), monopodial, the stem paniculately branched distally; *calyx-tube* scarcely pleated, the intervals charged with 2–3 small glands; *leaves* in the inflorescence with only 1–3 (4) pairs of leaflets. 30. *M. sarodes* (p. 117)

36. Fruticose or suffruticose, polypodial; *calyx-tube* strongly pleated, the intervals charged with 7–12 (17) glands; *leaves* in the inflorescence with 3–7 pairs of leaflets.

37. Stems erect, wandlike, mostly simple up to the relatively few-branched terminal panicle, the majority of racemes borne terminal to short branchlets or spurs axillary to the (drought-deciduous) main cauline leaves; *leaf-rachis* widely margined; *leaflets* crenulate but not fimbriolate at apex; s. Sonora to w. Jalisco along the Pacific slope of Sierra Madre Occidental, thence e. along the s. slope of Sierra Madre del Sur to w. Oaxaca. 28. *M. crenulata* (p. 114)

37. Stems diffuse, repeatedly and irregularly branching, the branches and ultimate branchlets tortuously flexuous; *leaf-rachis* scarcely margined (wing ± 0.1 mm wide); *leaflets* denticulate and fimbriolate at apex; known only from w. Jalisco. 29. *M. dispansa* (p. 116)

28. Blade of the banner open at base, the basal lobes not united across top of claw; *pod* not greatly compressed, nutlike, obscurely keeled across the top (no evident prow), the valves charged with many large blister-glands arranged in no discernible pattern, appearing uniformly bullate; *racemes* mostly 2–10-flowered.

38. Shrubs up to 2 m tall; *main cauline leaves* with 5–10 pairs of leaflets; *racemes* shortly 2–7-flowered, the axis 2–6.5 mm long; *pedicels* 1.4–2 mm long; *glands* in each interval of the calyx-tube confluent into a linear (sometimes interrupted) band; *blade of banner* ± 4–5 mm long, deeply emarginate; relatively rare sp. of the Pacific slope from w. Durango (and presumably adjoining Sinaloa) to s. Michoacán. 37. *M. grammadenia* (p. 131)

38. Monopodial annual herbs mostly 5–15 dm tall, with wandlike stem branched distally; *main cauline leaves* (deciduous by late anthesis) with 8–20 (some at least 12) pairs of leaflets; *racemes* loosely 2–9 (13)-flowered, the axis 0.5–3 (6) cm long in fruit; *pedicels* mostly 0.6–1.2 mm long; *glands* in each interval of calyx-tube 2–5, mostly either 3 or 4, small, discrete; *blade of banner* 2.8–3.8 mm long, usually acute and gland-tipped, the terminal gland rarely recessed into a shallow sinus; weeds of disturbed ground, widely dispersed through s. Mexico, centr. America, and adventive in Venezuela and Cuba, in Mexico n. sparingly to e. San Luis Potosí and adjoining Tamaulipas. 38. *M. scopa* (p. 132)

A. Sectio Marina

Pod laterally compressed, obovate or harp-shaped in profile view, its valves loosely investing the seed and charged on each face with blister-glands arranged in definite crescentic patterns (pustulate all over in monotypic ser. *Gemmeae*); style-base terminal on fully formed pod, but sometimes highly eccentric.

A(i). Series Chrysorrhizae (Rydberg) Barneby

Plant ± pubescent, but vesture sometimes reduced to a fringe of hairs around and within orifice of calyx; *teeth* of calyx often gland-spurred marginally but never glandular dorsally, the longest (dorsal) one not more than twice as long as tube; terminal leaflet often longer than last pair but hardly different in shape; *blade of banner* (and often of keel) gland-sprinkled; *pedicels* mostly short and firm. — Spp. 17, of the Sonoran Desert, Baja California outside the desert, and of w. slope of Sierra Madre Occidental s. into Sinaloa, 1 extending to e. slope of Sierra Madre in Chihuahua, 1 entirely of s. Mexico (Jalisco to Oaxaca).

Marina sect. **Marina** ser. **Chrysorrhizae** (Rydberg) Barneby, comb. nov., based on *Parosela* subgen. *Trichopodium* II *Chrysorhizae* [sic] Rydb., N. Amer. Fl. **24**: 51, pro maj. parte. 1919. — Sp. lectotypica: *Parosela chrysorrhiza* (Gray) Rydb. = **Marina chrysorrhiza** (Gray) Barneby.

Parosela subgen. *Trichopodium* III. *Divaricatae* Rydb., N. Amer. Fl. **24**: 54. 1919, pro max. parte (excl. *P. radicante*). — Sp. typica: *P. divaricata* (Benth.) Rose = **Marina divaricata** (Benth.) Barneby.

Parosela subgen. *Trichopodium* VIII. *Calycosae* Rydb., N. Amer. Fl. **24**: 61. 1919, pro parte (quoad spp. foliis vel caulibus pubescentes), typ. inclus. — Sp. typica: *P. calycosa* (Gray) A. Heller = **Marina calycosa** (Gray) Barneby.

The present section *Chrysorrhizae* is made up of parts of three Rydbergian sections of *Parosela* subgen. *Trichopodium*. From sect. *Chrysorrhizae* Rydb. I have extracted the nucleus of the typical species, with the related *P. peninsularis, P. goldmani, P. procumbens, P. parryi* and *P. palmeri*, but transferred *P. holwayi, P. pueblensis* and *P. spiciformis,* which have glandless banner, to ser. *Unifoliolatae*, and the ambiguous *P. neglecta* to ser. *Crenulatae*. I include the whole of Rydberg's group *Divaricatae*, which differ only in having an externally glabrescent calyx, with the exception of *P. radicans*, a genuine *Dalea.* Rydberg's group *Calycosae* contributes three species with both leaves and stems pubescent, the glabrous *P. filiciformis* and *P. berlandieri* being again genuine *Daleae* with pedicelled flowers. The group so formed is characterized by relatively short and firm pedicels, the presence of at least some pubescence, even if only a remnant about the mouth of the calyx, a gland-sprinkled banner, and a compressed pod charged with definite gland-crescents.

1. Marina parryi (Torrey & Gray) Barneby
(Plate VIII)

Slender, ultimately suffrutescent, perennial but often flowering the first season, 1.5–7 (12) dm tall, with a yellow taproot and stiff, wiry, sparsely leafy, diffuse or bushily erect, densely verruculose stems, simple only when dwarf, commonly branching from below the middle upward, usually glabrous and glaucous at base (or in age becoming so), the young growth and all ultimate branchlets with the leaves thinly to

densely strigulose with subappressed hairs up to 0.2–0.35 mm long, the foliage green or greenish-cinereous, the leaflets usually pubescent both sides, sometimes glabrous above, lineolate both sides, punctate beneath; *leaf-spurs* 0.3–1.2 mm long; *stipules* deltate-apiculate, triangular, or subulate and shortly attenuate, 0.3–1.4 mm long, the margins often charged with minute processes; *intra-petiolular gland* 1, small; *post-petiolular glands* small but prominent obtuse or prickle-shaped; *main cauline leaves* (drought-deciduous) 1.5–4.5 (6) cm long, shortly petioled, with (4) 5–11 (14) usually distant or remote pairs of orbicular-obcordate to obovate or broadly oblong-obovate, emarginate to retuse, flat, thick-textured leaflets 0.5–5 (7) mm long, all charged dorsally just below the apical sinus with a large gland and marginally on either side with 1–2 small ones, the latter often impressed and the leaflets thereby gland-crenulate; *peduncles* terminal and leaf-opposed, (0.5) 1–5 (9.5) cm long; *racemes* loosely or remotely many-flowered, the flowers falling in 2 ranks when pressed, the mature inflorescence without petals ± 7 mm diam, the strigulose axis becoming 2–10 cm long; *bracts* caducous, lance- or elliptic-acuminate or -caudate, mostly 1.5–3 mm, rarely caudate-acuminate and up to 5.5 mm long, firm, greenish or purplish, incurved at apex, pubescent dorsally, the margins gland-charged, sometimes appearing fimbriolate; *pedicels* 0.3–0.5 (0.6) mm long, charged at base and apex with a pair of glands; *calyx* (2.8) 3–4.3 (4.5) mm long, loosely strigulose to hirsute-pilosulous with stiff, ascending or spreading and incurved hairs up to 0.2–0.5 mm long, the tube 1.6–2 (2.1) mm, its ribs slender, becoming prominent, the recessed, membranous intervals charged with one row of 5–6 small glands extending from base of calyx upward, the teeth unequal, herbaceous, ovate, gland-appendaged, the dorsal one longest, 1.2–2.3 (2.6) mm long, 0.9 mm longer to 0.4 mm shorter than the tube, the rest ± broader and shorter; *petals* typically bicolored, the blade of the banner whitish with yellow, gland-sprinkled eye and blue sides or blue band all around the margin, the wings and keel (usually gland-sprinkled) perched below middle of the staminal column, their blades particolored (inner half blue, outer half whitish fading yellowish) or rarely blue-violet and concolorous; *banner* 2.8–4 mm long, the claw 1.6–2 mm, the deltate-cordate and acutish to reniform and emarginate blade 1.7–2.3 mm long, 2.5–3 mm wide; *wings* 3.3–4.8 mm long, the claw (0.8) 1–1.3 mm, the ovate to ovate-oblong, auriculate blade 2.6–3.8 mm long, (1.4) 1.6–2 mm wide; *keel* 5.1–7.1 mm long, the claws 1.7–2.4 mm, the elliptic-obovate blades 3.6–4.8 mm long, 2.4–3.2 mm wide; *androecium* 10-merous, (5) 5.5–7 mm long, the longer filaments free for ± 2 mm, the anthers 0.55–0.8 mm long; *pod* 1.8–2.4 mm long, puberulent and gross-glandular distally; *seed* 1.6–2 mm long; $2n = 10_{II}$ (Raven, Kyhos & Hill); n = 10 (Moore & Spellenberg, Taxon **21**: 163). — Collections: 153 (iii).

Rocky or sandy outwash fans, washes, and bouldery hillsides, mostly on granitic and volcanic bedrock, near sea-level up to 800 m (± 2700 ft) and recorded from 1150 m in Sierra de San Borja in Baja California (near lat. 28° N), widely dispersed and locally common over nearly the whole expanse of the Sonoran Desert from s.-e. San Bernardino County, California and Mohave County, Arizona through the Colorado and Yuma deserts to s. Sonora (Guaymas and Ciudad Obregón) and through the Gulf islands and along the peninsula of Baja California to the latitude of La Paz (near 24° N), extending e. in Arizona up the Gila valley and its tributaries into the Arizona Upland, and in Sonora (perhaps disjunctly) to the upper valley of Río Bavispe, in Baja California common and apparently continuous along the Gulf coast, becoming rarer w.-ward but reaching the Pacific coast in the Vizcaíno Desert (near Pta Abreojos) and at Magdalena Bay. — Flowering February to May, sometimes again in fall, or sporadically following summer rains, especially s.-ward. — *Representative*: CALIFORNIA.

San Bernardino: *Jones 3845* (NY, POM, UC); Riverside: *Wiggins 9672* (NY, UC); San Diego: *Munz 15,855* (POM, UC); Imperial: *Ferris 7144* (NY). ARIZONA. Mohave: *Thackrey 260* (NY); Yuma: *Keck et al. 6207* (NY, UC); Maricopa: *Eastwood 17,504* (CAS, NY); Pinal: *Maguire 10,875* (NY); Pima: *A. & R. Nelson 1533* (NY, UC); SONORA: *Wiggins & Rollins 107* (ARIZ, NY, UC); *Lowe & Turner 2983* (ARIZ); *Shreve 5829* (ARIZ), *7559* (ARIZ, F); *Gentry 4694* (ARIZ, NY), *3019* (ARIZ, F, UC). BAJA CALIFORNIA (Norte); *Hastings & Turner 63-103* (UC), *63-151* (ARIZ); *Chambers 637* (UC); *Raven, Mathias & Turner 12,588* (UC); *Wiggins 7699* (F, UC). BAJA CALIFORNIA (Sur): *Carter 4454* (NY, UC); *Shreve 7030* (ARIZ, F), *7081* (ARIZ, F); *Gentry 3724* (ARIZ, UC), *7411* (ARIZ, F), *7819* (ARIZ, UC), *4181* (ARIZ, UC).

Marina parryi (T. & G.) Barneby, comb. nov., based on *Dalea parryi* (Charles Christopher Parry, 1823–1890) T. & G. ex Gray, Proc. Amer. Acad. **7**: 397. 1868 (jul), based in turn on *D. divaricata* var. *cinerea* Gray, Proc. Amer. Acad. **7**: 335. "1867" [really 1868 (mar)]. — "Fort Mohave, on gravelly hills, Dr. J. G. Cooper." — Holotypus, collected 25 Feb, 1861, GH! isotypus, US! — *Parosela parryi* (T. & G.) A. Hell., Cat. N. Amer. Pl., ed. 2, 6. 1900. *P. divaricata* var. *cinerea* (Gray) Jtn., Proc. Calif. Acad. Sci. IV, **12**: 1046. 1924.

Dalea angulata (angled, of the calyx) Jones, Contrib. W. Bot. **16**: 25. 1930. — "No. 24881... growing among rocks at low elevations on the Baboquivari mountains, Arizona. September 22, 1929." — Holotypus POM! isotypi, NY (dated Sept 19), UC!

The Parry marina is the most widely dispersed and most frequently collected of a group of ten closely related species dispersed around the Gulf of California, but especially abundant and critical in the southern half of Baja California Sur and at the same latitudes in the foothills of Sierra Madre in Sinaloa. The range of *M. parryi* coincides almost exactly with the floristic province defined by Shreve and Wiggins as the Sonoran Desert, and over most of this immense region it is the only species of its type encountered, the few sympatric members of the genus being easily distinguished either by an annual root, or much smaller flowers, or stems pilose with divergent hairs. Southward from the latitude of Magdalena Bay, both on the peninsula of Baja California and on the Gulf islands, *M. parryi* either approaches or overlaps the ranges of several nearly related species and at the same time becomes quite polymorphic. In this critical area the populations are genetically much more diverse than northward, some of them sharing with a related species near at hand features that are foreign to *M. parryi* over most of its range. These relatively few intermediate types were interpreted by Johnston (1924) as evidence of full intergradation between *M. parryi* and *M. divaricata*, which he treated as varieties of one (sub *Parosela*). Critical specimens form only a scant fraction, however, of the material now accumulated in herbaria. It seems likely that they represent a remnant of the polymorphic matrix out of which *M. parryi*, coincident with its migration northward from a speciation-center in the Cape region and consequent isolation from back-crossing into the original gene-reservoir, has emerged as a relatively fixed and monomorphic species.

In Arizona, California, Sonora, and Baja California Norte the average plant of *M. parryi* is of moderate stature (stems ± 2–6 dm long) but varies considerably in habit. Young plants, in flower the first season, tend to have stems diffusely assurgent from the root-crown (or occasionally only one stem, then erect); given time and favorable conditions of soil and water these will develop into suffruticose plants of bushy outline. Independently of other features the pubescence varies somewhat in density, that of the calyx being sometimes subappressed and sometimes hirsutulous (this especially marked in the region of Guaymas). Normally the leaflets of major leaves are relatively few (to 7, 8, or 9 pairs); the bracts are short (to 3 mm, not or little longer than the flower-buds); and the petals are bicolored, the keel- and wing-blades being divided lengthwise into an inner half bright indigo-blue or

magenta-violet and an outer half (or margin) opening creamy-white but drying yellowish (a pattern particularly noted by Jepson, 1936, p. 335). Generally speaking, verruculose stems, small round and flat leaflets distantly disposed along the rachis, loose racemes of particolored flowers, and a characteristic pattern of glands in the calyx-intervals are reliable diagnostic features of *M. parryi*. The following variations seem to deserve special mention:

a. Petals all indigo-blue (the banner sometimes concolorous, sometimes with a pale eye in the blade). — This type has been collected chiefly on the Gulf islands: Islas Tortuga, San Marcos, n. to Isla Angel to La Guardia (*Wiggins 17,192,* NY; *Moran 8615, 8671, 8882,* all SD); an isolated, no doubt independent variant of the same sort has been collected near the northern limit of the species in the Colorado valley near Needles, California (*Alava 1722*, JEPS, UC).

b. Leaflets numerous (up to 13, 14, 15 pairs). — Gulf islands and adjoining mainland in and near lat. 25–26° N. (Isla Carmen; Misión Dolores; Isla San Francisco). — The plant from Misión Dolores (*Wiggins, Carter & Ernst 244*) is further remarkable for long bracts; that from Carmen (*Carter & Ferris 3728*, NY, UC) for its indigo, not particolored petals. All suggest an approach to the insular endemic *M. catalinae* and *M. oculata*, but have substantially smaller flowers.

c. Pod glabrous. — Isla San José (*Wiggins 17,656*). — This character appears shortly southward on the Cape region in *M. maritima* but is here combined with the gland-pattern on the calyx characteristic of *M. parryi*.

2. Marina divaricata (Bentham) Barneby

(Plate IX)

Perennial, suffrutescent becoming truly shrubby and up to 0.5–2 m tall, in dry, exposed places diffuse and twiggy, in sheltered canyons, washes, and open woodland becoming erect and bushy, commonly glabrous to the inflorescence but the leaf-rachis, the young branchlets and the leaflets of some upper leaves sometimes thinly pilosulous with spreading-incurved hairs up to 0.2–0.35 mm long, the purplish, glaucescent stems gland-verruculose, the foliage dark green or purpurascent, the leaflets lineolate above, punctate beneath, commonly gland-crenulate; *leaf-spurs* 0.5–1.5 mm long; *stipules* subulate or deltate-caudate, 0.7–2 mm long, livid, becoming dry and fragile; *intrapetiolular gland* globose or spiculiform; *post-petiolular glands* conical, prominent, orange or livid; *main cauline leaves* (drought-deciduous) 1–3.5 (4) cm long, short-petioled, the rachis very narrowly margined, the leaflets (6) 7–12 (13) pairs, oblong, oblong-obovate, or suborbicular, truncate to shallowly notched at apex, flat, thick-textured, 1–5 mm long; *peduncles* mostly leaf-opposed, 1.5–5 mm long; *racemes* at first conical becoming narrowly oblong-cylindric, moderately dense to quite loose and open, the flowers mostly 2-ranked when pressed, without petals ± 7–10 mm diam, the glabrous axis becoming 1.5–6 (10) cm long; *bracts* deciduous, lance-acuminate or -caudate, firm, green or livid-castaneous, 3–5.5 mm long, glabrous or thinly pilosulous dorsally, charged on the back and margins with glands, often appearing fimbriolate; *pedicels* ascending, 0.3–0.7 mm long, charged at base and near apex with a pair of fusiform yellow glands; *calyx* 2.9–4.5 mm long, glabrous except for the thinly ciliolate orifice, the pleated tube 1.6–2.6 mm long, the ribs prominent but very obtuse and appearing ± spongy-thickened, the intervals little differentiated in texture, charged in the upper half with 1–3 small but prominent blister-glands, the teeth unequal, the dorsal one longest, lanceolate, 1.1–2.1 mm long (0.6 mm shorter to slightly longer than the tube), incurved at tip, the rest broader, ovate-triangular, a little shorter to half as long as the dorsal one; *petals* bicolored, the banner blue with a yellow,

gland-sprinkled eye, the inner ones blue in the interior half, pallid or white externally, the keel inserted below middle of the androecial column; *banner* 2.5–3.4 mm long, the claw 1.5–1.7 mm, the reniform-emarginate to flabellate-cordate and acutish blade 1.5–2.2 mm long, 2–3 mm wide; *wings* 3.2–4.7 mm long, the claw 0.8–1.3 mm, the ovate to oblong-ovate, shortly auriculate blade 2.5–4.1 mm long, 1.4–2.7 mm wide; *keel* 5.3–6.8 mm long, the claws 1.6–2.3 mm, the broadly oval-obovate blades (4) 4.2–5 mm long, 2.4–3.1 mm wide; *androecium* 10-merous, 6–7.5 mm long, the longer filaments free for 2–2.7 mm, the pale blue anthers 0.5–0.6 mm long; *pod* 2.5–3 mm long, hyaline at base, charged above middle with 2 subvertical gland-crescents, glabrous; *seed* (little known) ± 2 mm long. — Collections: 31 (o).

Rocky washes and desert hillsides, ascending from coastal fog-desert at its n. limit into the oak-belt of the Cape mountains, reaching 1800 m (6000 ft) in Sierra de Laguna, apparently not uncommon along the west coast of Baja California Sur from Isla Magdalena s. to Cabo San Lucas and San Juan del Cabo, and on both slopes of the Cape mountains s. of lat. 24 ° N. — Flowering both in spring and fall, perhaps intermittently through the year. — *Representative*: *Orcutt 89* (F, NY, US); *Gentry 4185* (ARIZ, UC); *Wiggins 5541* (F, NY, UC); *Rempel* 71 (ARIZ); *Moran 6942* (SD), *7290* (NY); *Nelson & Goldman 7388* (NY, US); *Jones 24,329* (GH, POM, US); *J. H. Thomas 7844* (NY); *Carter & Chisaka 3521* (UC); *Gentry 4392* (ARIZ, F, UC); *Carter & Ferris 2680* (UC), *3340* (ARIZ, UC).

Marina divaricata (Benth.) Barneby, comb. nov., based on *Dalea divaricata* (spreading at wide angles, of the branches) Benth., Bot. Sulphur 12. 1844. — "Bay of Magdalena." — Holotypus, collected by Dr. Richard Brinsley Hinds, surgeon-naturalist aboard H. M. S. Sulphur, in Nov. 1839, K (herb. Benth.)! paratypi, attributed to George Barclay (*no. 3099*), BM, K (herb. Hook., 3 sheets)! — *Parosela divaricata* (Benth.) Rose, Contrib. U. S. Nat. Herb. **8**: 305. 1905.

Dalea anthonyi (Alfred Webster Anthony, 1865– , ornithologist) Bdg., Erythea **7**: 2. 1899. — "Common about San Jose del Cabo...It is No. 129, Proc. Cal. Acad., ser. 2, vol iii, 126 ["Dalea sp. San Jose del Cabo...Anthony's No. 352."]" — Lectotypus, collected at San José del Cabo, Sept 3, 1890, *T. S. Brandegee 129*, UC (herb. Bdg.)! isotypus, F! paratypi, *Anthony 352* (p. p.), F, MEXU, UC, US! — Cf. discussion infra. — *Parosela anthonyi* (Bdg.) Rose, Contrib. U. S. Nat. Herb. **12**: 272. 1909. *Dalea divaricata* ssp. *anthonyi* (Bdg.) Abrams, Contrib. Dudl. Herb. **3**: 50. 1940.

Parosela variegata (variegated, of the bicolored petals) Rydb., N. Amer. Fl. **24**: 55. 1919. — "Type collected at San Jose del Cabo, Lower California, October 24, 1902, T. S. Brandegee..." — Holotypus, US! — three topotypi collected by Brandegee (NY) are all differently dated and may represent other gatherings. — *Dalea variegata* (Rydb.) Gentry, Allan Hancock Pac. Exped. **13**[2] [Land Plants collected by *Velero III*...]: 134. 1949.

Marina divaricata is the prototype of a critical group of species endemic to the southern half of Baja California Sur, a group equivalent to Rydberg's *Parosela* sect. *Divaricatae* if *P. oculata*, misplaced in sect. *Diffusae*, is substituted for the less closely related *P. minor*. Johnston considered the group, so far as known up to 1924, as forming collectively a polymorphic entity only varietally distinct from the preceding species, *M. parryi*, but Wiggins (1940) dissented from this view, accepting *Dalea divaricata* with a subsp. *anthonyi* and *D. maritima* as independent species. Later Gentry (1949) has recognized *D. variegata*; and to these must be added *P. oculata* with two very local species described below as *Marina catalinae* and *M. capensis*. The differential characters of each member of the group are discussed seriatim under the next following five entries; here I propose only to comment on the separation of *M. divaricata* sens. str. from *M. parryi*.

As defined above, *M. divaricata* can be distinguished from *M. parryi* by its externally glabrous calyx of characteristically thick texture and by the presence of only 1–3 glands situated above the middle of each recessed fold of the tube. Accompanying this technical character and a significantly different range there are differences in habit and pubescence, *D. divaricata* being (at least potentially) a taller, more shrubby plant, with shorter, denser racemes, greener foliage, and a glabrous pod. Johnston was misled, I suspect, by the inclusion within his *P. divaricata* of the gray-pubescent *P. maritima*, which combines the calyx of genuine *M. divaricata* with the canescent stems of *M. parryi*. When *M. maritima*, with its characteristic aspect, coupled with a specialized habitat on dunes, is segregated, the supposed transition between *M. divaricata* and *M. parryi* disappears.

The material of *M. divaricata* collected in the type region around Magdalena Bay and along the coast southward to the latitude of La Paz is glabrous or nearly so up to the mouth of the calyx and the plants themselves assume the form of low, crooked shrubs often much less than one meter tall. The growth-habit no doubt reflects the environment of exceptionally arid fog-desert. In this same segment of the range the racemes tend to be short and few-flowered, and the calyx-teeth are short, the dorsal one varying from 1.1 to 1.6 mm long (always at least a trifle shorter than the tube). In the Cape region *M. divaricata* ranges inland along watercourses upward into the oak belt, reaching an elevation of 1800 m in the Sierra de Laguna. Along washes near the coast the plants achieve a stature of 2 m in some places, and become bushy in outline; in the mountains, where they are reported as associated with *Quercus devia* and *Q. idonea* in an open woodland community, they may be either similarly erect or diffuse and trailing. Southward, especially along and near the coast, some loose hairs appear on the leaf-stalks, the young twigs, and the dorsal (rarely also the ventral) face of even mature leaflets; and concurrently the dorsal calyx-tooth tends to elongate, reaching a length of 2.1 mm, but varying from 0.5 mm shorter to 0.2 mm longer than the tube. The phase with more or less pubescent foliage combined with relatively long calyx-teeth corresponds with *Parosela anthonyi* as misinterpreted by Rydberg, whereas that marked by glabrous foliage with long teeth is equivalent to the original *D. anthonyi* of Brandegee. Wiggins (1940, p. 50) has already remarked on the complete transition between the glabrous northern and the pubescent southern types and noted that they are not even fully segregated geographically. In the circumstances it seems unnecessary to recognize more than one variable entity.

The peculiar range of *M. divaricata*, with its great altitudinal and edaphic tolerance, is interesting because it embraces (at the same time that it somewhat surpasses) the combined ranges of two closely interrelated species of *Dalea, D. benthami* and *D. trochilina*. The former is sympatric with *M. divaricata* on the fog-desert of the Magdalena region and assumes a similar low, twiggy habit of growth. The latter is sympatric on the Cape sierras with the montane variant of *M. divaricata*, and like it varies in stature from an erect bush to a trailing subshrub. Obviously these two groups have had a long common history, although the daleas have in the course of time become spatially separated and morphologically discrete, whereas *M. divaricata* has maintained a continuous fabric of variation through an uninterrupted range.

The lectotypification of *Dalea anthonyi* requires a word of explanation. To conform with the protologue, the type must be subglabrous up to the orifice of the calyx. I have therefore selected Brandegee's own specimen as holotype. The paratype cited by Brandegee, *Anthony 352*, as represented by two sheets retained in the Brandegee collection (UC), has hirsutulous foliage, even though other material distributed under this number is glabrous. Rydberg (1919, p. 54) mistakenly interpreted *Parosela anthonyi* as the form with thinly pubescent leaves and redescribed the glabrous equivalent as *P. variegata*.

3. MARINA MARITIMA (Brandegee) Barneby
(Plate IX)

Closely related to *M. divaricata*, but more softly shrubby, the stems diffusely branched and trailing, forming low, entangled masses up to 2 m across, cinereously or canescently strigulose or strigulose-tomentulose with subappressed or with spreading and ± curly hairs up to 0.2–0.3 mm long, the leaflets similarly but more thinly pubescent on both sides, the old wood tardily glabrate and subglaucescent; *main cauline leaves* 1.5–4.5 cm long, the leaflets 7–11 (12) pairs, oblong-obovate, 1–4 mm long; *racemes* relatively dense, without petals 7–9 mm diam, the pilosulous axis 1.5–3.5 cm long; *bracts and pedicels* as in *M. divaricata*; *calyx* ± 3.6–4 mm long, shorn of its vesture exactly as in *M. divaricata* but either pilosulous externally from base upward or at least around the orifice and on back of the teeth with widely spreading white hairs up to 0.4–0.7 mm long, the tube 1.6–2 mm long, the dorsal tooth 1.8–2 mm long; *petals* in shape, relative proportions, and color as in *M. divaricata*, the keel-blades 4.5–4.9 mm long; *androecium* 6.5 mm, the anthers ± 0.8 mm long; *pod* glabrous or charged distally with a few scattered hairs. — Collections: 13 (o).

Barrier dunes behind the high tide line and sandy washes opening into the sea, below 20 m, local but apparently forming large colonies, both e. and w. coasts of s. Baja California Sur, s.-ward from La Paz: bay of La Paz and Gulf coast facing Cerralvo I.; Pacific coast from near Todos Santos s.-ward at intervals for ± 50 km; near San José del Cabo. — Flowering in winter and spring, perhaps at intervals through the year. — *Material*: BAJA CALIFORNIA (Sur). La Paz, *Palmer 79* (NY), *Jones 24,079* (ARIZ, F, POM, UC); ibid., road to Pichilinque, *Wiggins 14,560* (UC), *Hastings & Turner 64-155* (ARIZ); Bahía de los Muertos, *Wiggins 14,438* (UC); El Coyote, *D. M. Porter 110* (ARIZ, UC); 30 mi. n. of Todos Santos, *A. Johnson 58* (NY); 14 mi. s. of Todos Santos, *Gentry 12,358* (MICH); 35 mi s., *Chambers 882* (SD, UC). San José, *Rose 16,556* (NY, US).

Marina maritima (Bdg.) Barneby, comb. nov., based on *Dalea maritima* (of the sea) Bdg., Proc. Calif. Acad. Sci. II, **3**: 125. 1891. — "...in the sand of the ocean beach, just above high water mark, at Todos Santos and La Paz...also by Dr. Palmer at La Paz." — Holotypus, collected at Todos Santos, Jan 29, 1890, by T. S. Brandegee, UC (herb. Bdg.)! isotypus, NY! paratypi, *Brandegee 124, 124b* from La Paz, GH, UC! — *Parosela maritima* (Bdg.) Rose, Contrib. U. S. Nat. Herb. **8**: 304. 1905.

The material of *M. maritima* cited above shows some variation in the pubescence, variation of a sort that must be expected in its group. The stems may be either strigulose with appressed hairs or densely white-tomentulose, while the calyx may be hairy externally only on the teeth or from the base upward. The pod, commonly glabrous, occasionally bears a few scattered hairs at apex. Johnston (1924 p. 1046) reduced *M. maritima* to his inclusive concept of *P. divaricata* var. *cinerea* (= *M. parryi* of this account), but it is effectively separable by characters of the calyx combined with a denser spike, specialized habitat, and southern range. It is much more nearly related to *M. divaricata* as defined above, and may possibly consist of several ecotypes of that species modified by its maritime environment. Observant botanists who have collected *M. maritima* (Rose, M. E. Jones, Wiggins, Gentry) and *M. divaricata*, which is sympatric on the Cape but apparently found in rocky habitats when along the immediate coast, have all treated the two entities as distinct. A specimen however, from the Cape region (Arroyo de San Felipe, *Purpus 515*, UC) has the tomentulose stems of *M. maritima* with a calyx only shortly puberulent around the mouth, suggesting that intergradient populations may exist in greater numbers than are now known. The differential characters used by Wiggins (1940, p. 46, in clave) to separate *D. parryi*

and *D. maritima* are often ineffective. As already noticed, the pod of *M. maritima* may be either glabrous or thinly pubescent distally, and the petal-size is not significantly different.

M. E. Jones described (Contrib. West. Bot. **15**: 130) *M. maritima* as seen on the shores of La Paz bay in the following terms: "seldom rises more than 2 feet high but spreads along the ground with the lateral branches prostrate and often 6 feet long and slender. Flowers purple and white. Strongly odorous, perennial, and sometimes a little shrubby below, a vigorous grower with the habit of an *Astragalus*."

4. MARINA OCULATA (Rydberg) Barneby
(Plate X)

Related to and resembling *M. divaricata*, shrubby, either erect and up to 1 m tall or diffusely trailing and forming bushes much wider than high, the virgately or crookedly branching stems canescently strigulose when young with subappressed hairs up to 0.2–0.3 mm long, the old stems glabrescent and purplish-glaucescent, the foliage green, glabrous except for the sometimes puberulent leaf-rachis, the leaflets relatively thin-textured, the calyx glabrous externally, thinly ciliolate around the orifice; *leaf-spurs* 0.5–1 mm long; *stipules* linear-caudate, glabrescent, gland-spurred, becoming dry and fragile, 2–4 mm long; *intrapetiolular gland* prickle-shaped or spiculiform; *post-petiolular glands* 2, prominent, conic; *leaves* 2.5–7.5 cm long, with 11–20 pairs of oblong or oblong-elliptic leaflets 3–11 mm long; *peduncles* terminal and leaf-opposed, 0–4 cm long; *racemes* many-flowered, moderately dense, without petals 7–9 mm diam, the glabrous axis becoming 1.5–12 cm long; *bracts* lance-caudate, 2.5-5.5 mm long; *pedicels* stout, 0.3–0.4 mm long; *calyx* 3.6–4 mm long, the tube 2–2.2 mm, the intervals charged with 2–5 glands, the dorsal tooth ± 1.6–1.8 mm long, the rest shorter and broader, the ventral pair ciliolate; *petals* deep, vivid blue except for the yellow (rubescent), gland-sprinkled eye-spot on the blade of the banner, the inner petals perched ± 1–1.5 mm beyond the hypanthium-rim, sparsely glandular; *banner* 4–4.2 mm long, the claw ± 2 mm, the reniform or quadrate blade ± 2.3 mm long, 3.2–3.8 mm wide; *wings* 5–5.2 mm long, the claw 1.2 mm, the blade 4–4.4 mm long, 1.8–2.1 mm wide; *keel* 7.2–9 mm long, the claws 2–2.4 mm, the blades 5.1–6.8 mm long, ± 3.2 mm wide; *androecium* 6.2–8 mm long, the longer filaments free for 2.5–2.8 mm; *pod* almost of *M. divaricata*, glabrous. — Collections: 5 (o).

Stony beds of arroyos and rocky slopes, 10–150 m, known only from Isla Cerralvo off the Gulf coast of Baja California Sur in lat. ± 24° 15′ N. — Flowering February to May. — *Material* (all from Isla Carralvo): Arroyo Aguaje, 24° 18′ N., *Moran 9456* (NY, SD); at 24° 13′ N., *Moran 3619* (SD, UC); e. of Ruffo Ranch, *Wiggins 17,744* (NY, SD); w. side island, *Wiggins 17,699* (NY).

Marina oculata (Rydb.) Barneby, comb. nov., based on *Parosela oculata* (eyed, of the spotted banner) Rydb., N. Amer. Fl. **24**: 60. 1919. — "Type collected at Cerralvo, Lower California, April 19, 1911, *Rose 16884*..." — Holotypus, US! phototypus, NY!

Wiggins (1964, p. 665) disposed of *Parosela oculata* as a synonym of *Dalea divaricata*, but the species differs in its densely strigulose young branches, more numerous leaflets, larger flowers, and (disregarding the eye-spot on the banner, common to all close kindred) in the uniform blue coloring of the petals. The pubescence of the branchlets is like that of *M. maritima*, native to dunes along the shore opposite Isla Cerralvo, while the large flower is repeated, but with different leaves and calyx, in *M. catalinae*, a second insular endemic known only from a Gulf island distant some 170 km northward from Cerralvo. The glandular

ornamentation of *M. oculata*, and even more so that of *M. catalinae*, finds a closer match in *M. parryi* than in either *M. divaricata* or *M. maritima*. Under *M. parryi* (above) I have drawn attention to phases of it which depart from the norm in having either very many pairs of leaflets or petals vivid blue, sometimes coinciding with elongate bracts. These phases, all technically separable from *M. oculata* and *M. catalinae* by their relatively small corollas, are found on Gulf islands other than Catalina and Cerralvo and on the neighboring peninsula. It seems that these and the two insular endemics represent recent buds from the same genetic stem. A good case could be made for the union, as geographic subspecies, of all the entities mentioned in this paragraph. This policy would lead, however, by small but logically inevitable steps, into an unwieldy multiracial concept which would further absorb *M. palmeri, M. goldmani* and *M. alamosana* certainly, and perhaps also *M. minor*, that sequence of related vicariants which replace the *M. divaricata-M. parryi* complex along the Sierra piedmont in southern Sonora and Sinaloa. Discontinuities between all these members of ser. *Chrysorrhizae* are small; their classification as species nevertheless best serves taxonomic purposes.

5. Marina catalinae Barneby

(Plate X)

Suffrutescent, up to 4 dm tall and possibly taller, the proportionately stout, ascending stems branching from near the middle upward, densely charged with small, low-convex, livid blister-glands, appearing glabrous to the inflorescence but the leaf-rachis and stipule-margins thinly strigulose, the inflorescence gray-pilosulous, the foliage green, the thick-textured leaflets glabrous both sides, lineolate above, sparsely punctate beneath; *leaf-spurs* 0.5–1 mm long; *stipules* subulate, livid-glandular in texture, 0.5–1 mm long, deciduous; *intrapetiolular gland* prickle-shaped; *post-petiolular* glands prominent but obtuse, livid; *main cauline leaves* 2.5–4 cm long, shortly petioled, with narrowly thick-margined, stiff rachis and 8–15 pairs of rather distant, obcordate, flat or half-folded leaflets 1–2.2 mm long, the terminal one stalked, either smaller or larger than the last pair; *peduncles* terminal to all branches, 1–3.5 cm long (some appearing longer due to atrophy of some upper leaves); *racemes* many-flowered, moderately dense, the spreading-ascending flowers at full anthesis subcontiguous, when pressed falling in 2–3 ranks to expose the thinly pilosulous axis, without petals 9–10 mm diam, the axis becoming 1.5–10 cm long; *bracts* early deciduous, narrowly lance-caudate, 4–6 mm long, submembranous but not hyaline-margined, gland-ciliate or -fimbriolate, pilosulous and gland-charged dorsally, glabrous within; *pedicels* 0.4–0.6 mm long, bearing a pair of livid glands distally; *calyx* 4.5–5.2 mm long, pilosulous with ascending or incurved-ascending, silvery hairs up to 0.6–0.8 mm long, the tube 2.3–2.4 mm, corrugated by the prominence of the thick, castaneous or livid ribs, the membranous intervals charged with (3) 4–6 small glands in one row, the teeth unequal, the dorsal one longest, lanceolate, 2.1–2.9 mm long, the ventral pair ovate, shortest, all with flat herbaceous tips; *petals* bicolored, the banner with a pale, gland-sprinkled eye-spot surrounded by a broad purple margin, the keel and wings perched 1–1.4 mm above the hypanthium-rim, blue, the keel-blades sparsely gland-sprinkled; *banner* 5–5.6 mm long, the claw 2.5–3 mm, the transversely oblong to reniform blade openly emarginate, cordate at base, 2.6–3 mm long, 4 mm wide; *wings* ± 5.7 mm long, the claw 2 mm, the obovate blade 4.3 mm long, 2.7 mm wide; *keel* 9.2–9.6 mm long, the claws 3.2–3.7 mm, the blades 6.2–6.8 mm long, 3.5–3.9 mm wide; *androecium* 10-merous, 9.5–10 mm long, the longer filaments free for 3–3.2 mm, the connective gland-tipped, the anthers 0.8–0.9 mm long; *pod* apparently as in *M. oculata*, glabrous, but when young the gland-crescents confluent into continuous gland-bodies ± 1.5 mm long. — Collections: 3 (o).

Gravelly or rocky ridges and washes, from shore-line upward, 5–50 m, known only from Isla de Santa Catalina off the Gulf coast of Baja California Sur in lat. ± 25°40′ N. — Flowering March to May. — *Material*: BAJA CALIFORNIA (Sur): e. side of island (type-locality); ridge near middle of w. side of island, *Moran 9353* (SD).

Marina catalinae (of Isla de Santa Catalina) Barneby, sp. nov., *D. oculatae* proxima sed calyce extus dense pilosulo nec glabro, ramulis summis glabris nec cinereo-strigulosis, foliolis minimis carnosis vix 2.5 mm longis (nec oblongo-obovatis ad 4 mm usque longis) absimilis. A *M. parryi* cui calycis forma, pube glandulisque accedit imprimis habitu magis fruticoso, foliolis numerosis (ad 15-jugis usque), corolla maxima (carinae laminis 5–6.8 nec 3.7–4.8 mm longis), petalisque fere concoloribus saturate coeruleis ulterius distat. — BAJA CALIFORNIA (Sur): gravelly upper beach, east side of Catalina Island, elevation 5 m.... April 10, 1962, *Reid Moran 9367*. — Holotypus, SD. — Ibid., same date, *Wiggins 17,633*, MICH, NY (paratypi).

The likeness and differences between *M. oculata* and *M. catalinae*, listed in the foregoing diagnosis, can be visualized by comparison of the figures on Plate X. While they are alike in their large flowers and many leaflets, it seems probable that they arose independently, for the leaflet-shape and externally glabrous calyx of *M. oculata* suggest *M. divaricata*, found on the peninsula at the same latitude as Cerralvo Island, whereas the calyx and leaflets of *M. catalinae* evoke *M. parryi*, the common species on the peninsula northward. Some populations of *M. parryi* (further described above under that heading) found on Gulf islands close to Santa Catalina resemble *M. catalinae* in one or more features of leaflet-number, long bracts, or blue petals, and forcibly suggest the route by which *M. catalinae* may have reached its distinctive peak of differentiation, a peak which is very likely maintained only by its island habitat. All these forms of *M. parryi* may be distinguished by their small flower; most of them differ in at least one other differential feature and have at least thinly pubescent pods.

6. MARINA PALMERI (Rose) Barneby
(Plate VIII)

Perennial, sometimes in flower when only 1.5 dm tall but becoming suffruticose and (reportedly) up to 1 m tall, with tough yellow root and slender livid, simple or paniculately branching, sparsely leafy stems charged with small warty glands, glabrous to the calyx or nearly so, the young twigs and leaf-rachis of some young leaves sometimes obscurely puberulent, the foliage green, the leaflets lineolate above, punctate beneath, their margins also charged with impressed glands; *leaf-spurs* very short or obsolete; *stipules* narrowly triangular to linear-subulate, livid becoming dry and fragile, 0.3–1 mm long; *intrapetiolular gland* small but prominent; *post-petiolular glands* small, obtuse or prickle-shaped; *main cauline leaves* (drought-deciduous) 1–3 cm long, shortly petioled, with narrowly margined rachis and (6) 7–11 (13) pairs of rather distant, oblong-obovate to suborbicular, emarginate, bluntly gland-mucronate, flat leaflets 1–2.5 (3) mm long; *peduncles* terminal and leaf-opposed, 0.5–2.5 cm long; *racemes* openly or remotely many-flowered, the flowers well-separated and 2-ranked when pressed, without petals ± 5.5 mm diam, the glabrous axis becoming 2–8 cm long; *bracts* deciduous, lanceolate beyond the cuneate base, 0.8–2.5 mm long, early becoming papery, castaneous, glabrous dorsally, gland-fimbriolate; *pedicels* 0.3–0.5 mm long, charged at base and distally with a pair of glands; *calyx* 2.2–2.7 mm long, pilosulous along the ribs with stiffly ascending-incurved hairs up to 0.2–0.35 mm long, the tube 1.3–1.6 mm long, the ribs prominent, obtuse, the narrow, recessed intervals membranous, charged with 1 row of (3) 4–5 small, elliptic glands, the teeth herbaceous, somewhat unequal, the ovate-lanceolate dorsal one 0.9–1.2 mm long, the rest a little

broader and shorter; *petals* bicolored, blue and white, except for smaller size like those of *M. parryi* in position, shape and color; *banner* 2–2.4 mm long, the claw 1.1–1.4 mm, the blade 1–1.5 mm long, 1.3–2.2 mm wide; *wings* ± 3.3 mm long, the claw 0.9 mm, the blade 2.6 mm long; *keel* 3.9–4.5 mm long, the claws 1.2–1.6 mm, the blades 2.9–3.2 mm long, 2–2.3 mm wide; *androecium* 4.2–5.5 mm long, the longer filaments free for 1.3–1.8 mm, the connective gland-tipped, the anthers 0.5–0.55 mm long; *pod* 1.6–2 mm long, glabrous (rarely 1–2 minute hairs at tip), otherwise as *M. parryi*. —Collections: 9 (o).

Brushy hillsides at ± 200–600 m (650–1000 ft), with mesquite or in short tree forest, lower foothills and adjoining coastal plain of s. Sonora and adjoining Sinaloa, on forks of Ríos Mayo, Fuerte, and Mocorito; disjunctly in s. Sinaloa (mpo. Mazatlán) but to be expected in intervening stations. —Flowering September to March. —*Material*: SONORA. Alamos: Cañón Sapopa, *Gentry 1051* (ARIZ, F); Alamos, *Rose, Standley & Russell 12,758* (NY), *13,064* (F, NY), approximate topotypi. SINALOA. El Fuerte: San Blas, *Rose, Standley & Russell 13,617* (NY, US); El Fuerte, no. *13,536* (NY, US); Satique, *Gentry 944* (MICH). Mocorito: Terreros, *Breedlove 1517* (MICH). Mazatlán: La Noria, *Ortega 6090* (MEXU).

Marina palmeri (Rose) Barneby, comb. nov., based on *Parosela palmeri* (Edward Palmer, 1831–1911) Rose, Contrib. U. S. Nat. Herb. **8**: 304. 1905. —"Collected by Dr. E. Palmer near Alamos, Sonora, September, 1890 (no. 739)." —Holotypus not found at US; isotypi, GH, MEXU, NY! —*Dalea palmeri* (Rose) Riley, Kew Bull. **1923**: 337. 1923; Gentry, Rio Mayo Pl. 139. 1942, as comb. nov.

This is closely akin to *M. parryi*, differing chiefly in its smaller calyx and petals and, less importantly, in the loss of pubescence, the hairs being reduced often to the stiff incurved ones borne along the ribs of the calyx, either from base upward or upward from the middle. The young branchlets and young leaves are sometimes glabrous but sometimes bear a thin or rudimentary vesture. Rose, who knew it in the field, described *P. palmeri* as shrubby and up to a meter tall; on the other hand, plants have been collected near Alamos already in flower when only 1.5 mm tall, the stems then stiff but not at all fruticose. Near Mocorito Breedlove saw it as "suffrutescent, climbing over bushes", while on Rio Mayo Gentry found it in the shape of a "small leafy, procumbent perennial, forming a low bush." The habit of the fully grown individual seems to differ from that of *M. parryi*, but is not shown clearly by the majority of herbarium specimens. The "25 pairs" of leaflets described in the protologue must be a slip for 25 leaflets.

The ranges of *M. parryi* and *M. palmeri* coincide neatly with the floristic boundary of the Sonoran Desert as defined by Shreve and Wiggins. The former nearly attains the southern boundary of the Desert near Cajemé, Sonora, and is abruptly replaced by its relative in the first major drainage system to the southeast.

7. MARINA CAPENSIS Barneby

(Plate XI)

Herbaceous, with several slender but stiff, purplish, procumbent stems arising close together from near the crown of the slender, apparently annual taproot, simple or forking distally, up to 3.5 dm long, glabrous and gland-tuberculate throughout, glaucescent toward the base, the foliage (especially the leaf-rachis) thinly pilosulous with spreading-incurved hairs up to 0.25–0.35 mm long, the leaflets thick-textured, hairy both sides or only beneath, gland-dotted dorsally; *leaf-spurs* 0.4–1 mm long, charged at apex on either side with a livid prickle-gland; *stipules* subulate, 0.6–1.5 mm long, livid, often gland-spurred on margins; *intrapetiolular gland* 1, prominent, prickle-

shaped; *post-petiolular glands* similar, 2; *main cauline leaves* 2.5–5 cm long, shortly petioled, with slender, very narrowly margined rachis and 11–18 pairs of slender-petiolulate, oblong-obovate, emarginate, flat leaflets 1.5–2.5 mm long, charged dorsally at tip with a large gland, the upper leaves shorter, with only 9–12 pairs of smaller leaflets; *peduncles* borne above middle of stem, mostly leaf-opposed, 0.5–3.5 cm long; *racemes* loosely and narrowly many-flowered, the flowers 2-ranked when pressed, without petals 5–6 mm diam, the incurved-ascending, glabrous axis becoming 2.5–4 cm long; *bracts* deciduous, narrowly ovate-acuminate, early becoming papery and brownish, 1.7–2.5 mm long, thinly pilosulous distally; *pedicels* 0.4–0.5 mm long, the apical glands prominent; *calyx* ± 2.8 mm long, pilosulous along the ribs and about the flat, herbaceous teeth with incurved hairs up to 0.2–0.25 mm long, the tube 1.2 mm long, the ribs prominent, obtuse, the narrow, deeply recessed intervals charged with one row of 4–5 small, transparent glands, the teeth unequal, the dorsal one lanceolate, ± 1.6 mm, the shorter and proportionately broader ventral pair shortest, united slightly higher behind the banner; *petals* particolored, the banner yellow-eyed and blue-margined, the rest divided lengthwise into blue inner and whitish (or when dry yellowish) outer bands of nearly equal width, all gland-sprinkled, the inner ones elevated not more than ± 1 mm above the hypanthium; *banner* 2.4–2.6 mm long, the claw 1.2–1.3 mm, the subquadrate-reniform blade 1.5–1.6 mm long, 2.2–2.4 mm wide; *wings* 3.2 mm long, the claw 0.7 mm, the blade 2.7 mm long, 1.7 mm wide; *keel* ± 4.5 mm long, the claw 0.9 mm, the blade 3.7 mm long, 2.3 mm wide; *androecium* 10-merous, ± 4.5 mm long, the longest filament free for 1.5 mm, the anthers bluish, gland-tipped, 0.6–0.7 mm long; *ovary* glabrous. — Collections: 1 (o).

Gravelly hillsides below 100 m, known only from the type-locality near Todos Santos, on the Pacific slope of Baja California Sur immediately below the Tropic of Cancer. — Flowering in December and January.

Marina capensis Barneby, sp. nov., *M. parryi* (T. & G.) Barneby ac *M. divaricatae* (Bth.) Barneby arcte affinis, ab ambabus foliolis foliorum majorum magis numerosis (11–18- nec 5–12-jugis) cum floribus minusculis ovarioque glabro recedens. A sympatrica *M. divaricata* ulterius differt radice annua; a *M. peninsulari* (Rose) Barneby simul sympatrica ac annua caulibus rigidis, foliolis plurijugis, racemis longioribus, ovario glabro longius distat. — BAJA CALIFORNIA (Distr. Sur): gravelly hillside 2.8 mi S of Todos Santos along road to Cabo San Lucas, December 25, 1958, *Ira L. Wiggins 14,523*. — Holotypus, NY; isotypi, DS, ENCB, TEX, US.

I am reluctant to describe further entities in the complex group related to *M. divaricata*, already numerous in the Cape region, but I cannot assimilate the typus of *M. capensis* into any of the several similar, sympatric or nearly sympatric forms. In general the plant most nearly resembles *M. divaricata* itself. The glaucescent, warty stems, the thin, pilosulous pubescence of the foliage, and the coloration of the flower are essentially the same, but the root is annual, the flower substantially smaller, and the leaflets of the main cauline leaves are 12–18 not 7–11 (12) pairs. Many individual plants of *M. parryi* flower the first season and some of them may have flowers nearly as small as that of *M capensis*; these, however, have relatively few leaflets, a pilosulous pod, and occur far northward on the Peninsula. Three diffuse, annual, small-flowered species of *Marina* are found in approximately the same latitudes as *M. capensis*, but only one of them, *M. peninsularis*, has prominently warty stems. This, too, has fewer leaflets (mostly 4–7, exceptionally 10 pairs), stramineous, pliant, pilosulous stems, shorter racemes, and pilosulous ovary and pod. Another close relative is *M. parryi* native along the foothills of the Sierra Madre in Sinaloa and southern Sonora, not yet found in Baja California. It is like *M. capensis* in having a small flower and glabrous ovary, but once again differs in fewer leaflets, in being nearly glabrous below the spikes, in the perennial root, and in the ultimately shrubby habit of growth.

8. Marina minor (Brandegee) Barneby
(Plate XII)

Slender, diffuse, from a tough perennial taproot, appearing glabrous, the base of stem and lower leaves truly or nearly so, but distally becoming finely and thinly strigulose with subappressed and ascending hairs up to 0.15–0.25 mm long, the foliage green, the leaflets lineolate both sides, minutely punctate beneath; *stems* (2) 3–9 dm long, prostrate with ascending tips, freely and irregularly branching, purplish or pinkish-brown, sparsely low-tuberculate distally, floriferous upward from above the middle, the spikes mostly leaf-opposed; *leaf-spurs* subobsolete up to 0.5 mm long; *stipules* narrowly subulate to linear, 0.7–2 mm long, papery, brownish-purple, the margins sometimes minutely gland-spurred; *intrapetiolular gland* spiculiform; *post-petiolular glands* small but prominent, subulate; *main cauline leaves* (drought-deciduous) 2.5–6.5 cm long, shortly petioled, with subterete, minutely gland-sprinkled rachis and 9–24 pairs of narrowly oblong to oblong-obovate, truncate-emarginate, flat leaflets 1.5–4 mm long, the rameal leaves shorter, with smaller and fewer leaflets; *peduncles* 0.3–4 cm long; *racemes* ± 15–40-flowered, the subcontiguous flowers ascending, ± 2-ranked when pressed, without petals 6–8 mm diam, the strigulose axis becoming (1) 2–5 cm long; *bracts* persistent, becoming brown and papery, lance-elliptic, 1.4–2.5 mm long, eglandular dorsally but sometimes gland-toothed marginally; *pedicels* stout, erect, 0.2–0.6 mm long, sometimes scarcely visible at anthesis, charged at base and apex with a pair of glands; *calyx* 4.3–4.9 mm long, glabrous or nearly so below the thinly strigulose or merely ciliolate, inwardly pubescent teeth, the tube 1.7–2.2 mm long, strongly pleated, pale green, the ribs prominent but hardly differentiated from the firm intervals, these charged near or slightly above the sinuses between the teeth with 1–2 (3) brown blister-glands, the green or purplish, herbaceous teeth strongly unequal, the dorsal one longest, lanceolate, 1.8–2.9 mm long (0.1–0.9 mm longer than the tube), the rest lance-ovate, shorter; *petals* bicolored, all sprinkled with small glands, the banner whitish (sometimes with purple basal lobes) but rubescent, the wings and keel inserted well below middle of staminal column, their blades blue or purple with a broad or narrow whitish stripe along the external margins; *banner* 3.7–5 mm long, the claw 1.6–1.9 mm, the suborbicular-cordate, truncate or emarginate blade 2.3–3.4 mm long, 3.2–4 mm wide; *wings* 4.2–4.7 mm long, the claw 0.8–1.1 mm, the obliquely ovate blade 3.7–4 mm long, 2.1–2.7 mm wide; *keel* 7–7.4 mm long, the claws 2.1–2.4 mm, the obovate-elliptic blades 5–5.4 mm long, 3–3.2 mm wide; *androecium* 10-merous, 6.5–7.8 mm long, the longest filaments free for 2–2.9 mm, the anthers all alike, or sometimes 5 sterile, small, and 5 fertile and 0.7–1 mm long, the connective gland-tipped; *pod* 2.7–3 mm long, obovate in profile, the short style-base terminal, the valves membranous at very base, papery distally and charged with 2 vertical gland-crescents, glabrous or becoming so; *seed* pale brown, smooth, ± 1.8 mm long. — Collections: 7 (o).

Open gravelly and turfy hillsides, ascending from the first foothills of Sierra Madre up into the edges of oak woodland, 25–1200 m, apparently local, centr. Sinaloa and adjoining Durango. — Flowering September to March. — *Material*: Sinaloa. Sinaloa y Vela: Mocorito to Surutato, *Breedlove & Thorne 18,622* (NY). Badiraguato: Badiraguato, *Gentry 5780* (ARIZ, NY); Cieneguita s.-e. of Badiraguato, *Gentry 5942* (ARIZ). Culiacán: Cofradía, *Brandegee in 1904* (UC); Lodiego (typus); n.-w. base of Cerro Colorado, *Gentry 5187a* (ARIZ, F, MEXU, MICH, NY, UC). Durango. Canelas: Sa. Tres Picos, *Gentry 5336* (ARIZ, MEXU, MICH, NY, US).

Marina minor (Rose) Barneby, comb. nov. based on *Parosela minor* (smaller, apparently by comparison with *M. divaricata*, sens. lat.) Rose, Contrib. U. S. Nat. Mus. **8**: 305. 1905 (Apr). — "Collected by Dr. E. Palmer at Lodiego [on Río Tamazula above Culiacán, near the Durango line; cf. McVaugh, 1956, p. 245], Sinaloa, October 9–15, 1891 (no. 1624)." — Holotypus, US! isotypi, C, F, NY, UC! — *Dalea minor* (Rose) Brandg., Zoë **5**: 201. 1905 (Aug).

The present species together with the two next following, *M. goldmani* and *M. alamosana*, differ collectively from the Sonoran *Chrysorrhizae* described up to this point by having stems much less prominently glandular, not truly verruculose, the few glands, when present or at all prominent, being low and lenslike. The trio form a replacement series along the Pacific foothills of Sierra Madre between Río Mayo in southern Sonora and Río Tamazula in south-central Sinaloa, each being confined to a small segment of the common range. They are alike in growth-habit, diffuse perennial herbs with radiating, stiffly humifuse stems that branch indefinitely and bear a succession of leaf-opposed racemes all through the late fall and winter months. In the context of the group, *M. minor* is poorly named. It is a relatively coarse plant, forming loosely woven mats of foliage which late in the growing season can reach a diameter of nearly two meters. It is the most southern of the three, and easily distinguished from its neighbor next to the north, *M. goldmani*, by its green, glabrous or thinly strigulose, never gray-pilosulous foliage, by its externally glabrous calyx, and by the persistent bracts which remain in place long after the flower has faded and the fruit has formed. The calyx of *M. minor* recalls that of the peninsular *M. divaricata* because of its shining, hairless tube charged only above the middle with but one or two (exceptionally three) prominent brown blister-glands; but the whole plant differs in habit, in the nearly smooth stems, and especially in the persistent bracts which are unique in ser. *Chrysorrhizae*, although found in one South Mexican annual of ser. *Unifoliolatae*.

9. Marina goldmani (Rose) Barneby
(Plate XIII)

Prostrate or procumbent perennial, the irregularly branching, pink- or purplish-brown, low-tuberculate stems up to ± 5 dm long, pilosulous throughout with stiff, vertically spreading or widely recurved hairs up to 0.3–0.4 mm long, the old stems finally glabrate, the foliage cinereous, the leaflets lineolate and pilosulous both sides, minutely punctate beneath, the margins charged with a few glands; *leaf-spurs* 0.4–1 mm long; *stipules* thinly herbaceous becoming papery, deltate-triangular to narrowly subulate, 0.8–2.2 mm long; *intrapetiolular gland* spiculiform; *post-petiolular glands* prominent, subulate, 0.3–0.5 mm long; *main cauline leaves* 1.8–3.5 cm long, shortly petioled, with scarcely margined, minutely tuberculate rachis and 10–15 pairs of ovate-oblong to suborbicular, truncate-emarginate, bluntly gland-mucronulate, distally crenulate-dentate, flat leaflets (2) 2.5–3.5 mm long, the rameal leaves shorter, with fewer pairs of smaller, more crowded leaflets; *peduncles* mostly leaf-opposed, relatively stout, 6–16 mm long; *racemes* ± 15–40-flowered, spiciform, the pedicels subobsolete, not over 0.2 mm long, the subcontiguous flowers becoming 2–3-ranked when pressed, without petals 7–8 mm diam, the pilosulous axis ± 2–4.5 cm long; *bracts* deciduous either promptly or at least by late anthesis, narrowly lance-acuminate, 2–3 mm long, becoming brown and papery, toothed or gland-spurred on either margin, thinly hirsutulous dorsally; *calyx* 3.7–5 mm long, rather thinly hirsutulous with stiff, white, spreading-incurved hairs up to 0.3–0.4 mm long, the tube 1.6–1.8 mm, the ribs prominent, thick, castaneous, the recessed intervals pallid-membranous, charged

above middle with 1–2 (3) glands, the teeth very unequal, the dorsal longest, lanceolate 1.9–3.4 mm long, the ventral pair united a trifle higher than the rest, ovate-deltate, 1–1.2 mm long, the plane herbaceous tips of all gland-spurred, or the dorsal one distinctly toothed; *petals* somewhat bicolored but not brightly so, all ± gland-sprinkled, the banner whitish (with sometimes purple-tipped basal lobes), faintly rubescent in age, the inner ones perched 0.5–1.6 mm from hypanthium rim, their blades pink or purple with a pale stripe along their external edges; *banner* 3.3–3.5 mm long, the claw 1.3–1.5 mm, the suborbicular-reniform, emarginate, hooded blade 2–2.3 mm long, 2.6–3.4 mm wide; *wings* 3.7–4 mm long, the claw 0.8–1.2 mm, the oblong-ovate blade 3.3–3.8 mm long, ± 1.8 mm wide; *keel* 5.6–5.8 mm long, the claws 1.6–2.1 mm, the obliquely ovate-elliptic blades 4–4.3 mm long, ± 2.4 mm wide; *androecium* 10-merous, 5.5–6.7 mm long, the longer filaments free for 1.8–2.2 mm, the connective gland-tipped, the bluish anthers 0.65–0.75 mm long; *pod* ± 2.6 mm long, obliquely ovoid in profile, the style-base terminal but eccentric, the valves transparent in lower ⅓, smooth and firm distally, barbate-pilosulous in upper half, the faces charged with 2 subvertical gland-crescents. — Collections: 3 (o).

Grassy slopes within and near the lower edge of the oak-belt, ± 650 m, local, known only from the lower slopes of Sierra Madre drained by Río Fuerte, in extreme s.-e. Sonora and adjoining Sinaloa. — Flowering September to April. — *Material*: SONORA. Alamos: Guirocoba, *Gentry 5955* (ARIZ, MICH, NY); Colmoa, *Gentry 920M* (MICH). SINALOA. Choix (type).).

Marina goldmani (Rose) Barneby, comb. nov., based on *Parosela goldmani* (Edward Alphonso Goldman, b. 1873) Rose, Contrib. U. S. Nat. Herb. **8**: 305. 1905. — Collected by E. A. Goldman on Sierra de Choix, Sinaloa, October 17, 1899 (no. 267)." — Holotypus, US! isotypi, GH, NY! — *Dalea goldmani* (Rose) Riley, Kew Bull. **1923**: 337. 1923.

Rydberg (1919) referred *Parosela goldmani* to sect. *Chrysorrhizae* and compared it with *P. peninsularis*, thereby evading the responsibility of contrasting it directly with *P. alamosana*, aligned in sect. *Calycosae* next to *P. calycosa* and *P. orcuttii*. Rydberg's two sections were supposed to differ in the relative length of calyx-tube and -teeth, but so far as proportions are concerned the calyces of *P. goldmani* and *P. alamosana* are essentially identical. They are much alike in habit, in fine detail of the flower, and in the pod, and are vicariant neighbors within a small sector of Sierra Madrean foothill woodland, adapted to essentially the same environment. They are very closely related and could well be interpreted as geographic subspecies, differing, however, in a number of small points which assume importance insofar as they hold together. Because *M. goldmani* is in the foregoing key to *Marina* once again separated rather artificially from *M. alamosana* because of differences in vesture, it will be as well to state the differential characters formally:

1. Stem and leaf-rachis charged with low-convex glands; pubescence of leaves hirsutulous, spreading-incurved; leaflets gland-margined, the margins crenulate distally; calyx thinly hirsutulous (mostly on the ribs), the intercostal membranes charged above middle of calyx-tube with 1–2 (3) glands; pod hyaline in lowest ⅓; drainage of Río Fuerte. extreme s. Sonora and adjoining Sinaloa. *M. goldmani.*
1. Stem and leaf-rachis eglandular (glands if present minute and fully immersed); pubescence of leaves strigulose, subappressed; leaflets not gland-margined, the margins entire; calyx densely hirsutulous all over, the intercostal membranes charged with 3–4 glands, these not situated all above the middle of tube; pod hyaline only at extreme base; drainage of Río Mayo, from Alamos, Sonora, upstream just into Chihuahua. *M. alamosana.*

In the material examined the flowers of *M. alamosana* are slightly smaller, the anthers a trifle shorter, and the coloration of the flower paler than in *M. Goldmani*. However, Gentry calls the flower of his *M. goldmani* from Guirocoba (distributed, interestingly enough, as "*Dalea alamosana*, but leaves hirsute") white drying pale lavender; they were apparently paler than those of the type-collection which came from only a short distance southward. Further collections may, of course, reveal other signs of intergradation between the two. In the number and position of the calyx-glands *M. goldmani* recalls *M. minor*, which replaces it along the Sierra southward; for differential characters see discussion of the latter, immediately above.

10. Marina alamosana (Rose) Barneby
(Plate XIII)

Slender, prostrate or procumbent perennial herb from tough yellow roots, loosely strigulose up to the inflorescence with subappressed and narrowly incurved-ascending hairs up to 0.15–0.3 mm long, the flexuously wiry, brownish, terete, eglandular stems branching from near the base, floriferous from middle upward, (1) 1.5–4 dm long, the foliage greenish-cinereous, the leaflets lineolate above, minutely punctate beneath, pubescent both sides; *leaf-spurs* up to 0.5 mm long; *stipules* narrowly subulate, brownish or livid-castaneous, becoming papery, 0.6–1.4 mm long; *intrapetiolular gland* minute or 0; *post-petiolular glands* small but prominent, prickle-shaped, orange; *main cauline leaves* (drought-deciduous) (1) 1.3–3.5 cm long, shortly petioled, with scarcely margined rachis and (6) 7–12 (14) pairs of oblong-obovate to suborbicular, emarginate, flat leaflets (1) 1.2–2.5 (3.5) mm long, those of rameal leaves fewer and smaller; *peduncles* mostly leaf-opposed, 0.3–2 (3) cm long; *racemes* spiciform, relatively short and dense, the flowers loosely contiguous and 2–4-ranked when pressed, without petals 6–7 mm diam, the pilosulous axis becoming 0.6–2 cm long; *bracts* rather tardily deciduous, ovate- or lance-acuminate, 1.5–2.5 mm long, herbaceous becoming papery and brownish, strigulose dorsally, the margins gland-appendaged and sometimes obscurely toothed on either side; *pedicels* subobsolete or up to 0.25 mm long, charged with minute glands at apex; *calyx* 3.7– 4.2 mm long, densely pilosulous with stiff, spreading and upwardly incurved hairs up to 0.45–0.55 mm long, the tube 1.2–1.6 mm, the ribs slender becoming prominent, the narrow, recessed, membranous intervals charged with 3–4 glands in one row, the plane herbaceous teeth unequal, the dorsal one longest, lanceolate, constricted at base, 2.3–2.8 mm long, sometimes with 1 tooth on each side, the rest shorter, ovate or lance-ovate, the ventral pair 1.2–1.6 mm long; *petals* whitish tipped with lavender, the banner with yellowish eye-spot, all gland-sprinkled, the inner perched 0.8–1.4 mm above hypanthium rim; *banner* 2.3–2.8 mm long, its claw ± 1.3 mm, the broadly ovate-flabellate-cordate or reniform, emarginate or minutely acuminate blade 1.6–2 mm long, 1.6–2.7 mm wide; *wings* 2.8–4 mm long, the claw 0.7–1.2 mm, the broadly obliquely ovate to oblong-ovate blade 2.2–2.9 mm long, 1.3–1.7 mm wide; *keel* 4.6–5.5 mm long, the claws 1.2–2 mm, the elliptic-obovate blades 3–3.8 mm long, 1.7–2.2 mm wide; *androecium* 10-merous, 4.5 5.5 (6) mm long, the connective gland-tipped, the blackish finally pale blue anthers 0.5–0.6 mm long; *pod* ± 2.5 mm long, in profile obovate, the style-base terminal but eccentric, the valves hyaline at very base only, firm distally, pilosulous and charged with 2 subvertical gland-crescents; *seed* (seldom seen) ± 1.8 mm long. — Collections: 8 (o).

Grassy and brushy slopes in Short-tree Forest, ascending to the lower edge of the oak belt, 240–750 m (± 800–2500 ft), apparently not uncommon in the foothills and piedmont of Sierra Madre drained by Río Mayo in s.-e. Sonora and immediately adjoining Chihuahua. —Flowering September to March. —*Material*: CHIHUAHUA. Uruáchic: Guasaremos, *Gentry 2885* (ARIZ, F, UC). SONORA. Alamos: Alamos, *Rose, Standley & Russell 12,942* (NY, US), *Gentry 4785* (ARIZ, F, MEXU, NY, SD), *Drouet & Richards 3984* (F), *Ripley 14,245* (CAS, NY); San Bernardo, *Gentry xo* (F); Agrimensor, *Gentry 453* (ARIZ).

Marina alamosana (Rose ex Rydb.) Barneby, comb. nov., based on *Parosela alamosana* (of the type-locality) Rose ex Rydb., N. Amer. Fl. **24**: 63. 1919. —"Type collected at Alamos, Sonora, September 1890, *Edward Palmer 711...*" —Holotypus, US! isotypi F, GH, MEXU, NY! —*Dalea alamosana* (Rose ex Rydb.) Bullock, Kew Bull. **1939**: 194. 1939.

Comment on the supposed relationship of *M. alamosana* to *M. goldmani* and *M. minor* will be found in the discussion of the two preceding species. Rydberg associated *M. alamosana* with *M. calycosa* and *M. orcuttii*, but *M. calycosa* differs notably in the absence of protuberant glands behind the petiolules, while both are quickly separated in advanced anthesis by the nodding flowers which give a characteristic aspect to the spike. Neither *M. orcuttii* nor *M. calycosa* are known to occur within the range of *M. alamosana* but the range of *M. calycosa* in Mexico is probably not fully known. If found in the Río Mayo basin it will be easily distinguished from *M. alamosana* by the large size of the individual flower.

11. MARINA CALYCOSA (Gray) Barneby
(Plate XIV)

Dwarf, loosely tufted, with a tortuous perennial root and short caudex or knotty root-crown situated 1–3 cm below soil-level, the slender, decumbent and incurved, eglandular or obscurely and remotely glandular, purplish or stramineous stems 5–20 cm long, simple or more often branched (upward from near base or only distally) at 1–5 nodes, the first raceme leaf-opposed, the rest usually terminal to branchlets, the stems and foliage strigulose with appressed and narrowly ascending hairs up to 0.25–0.5 mm long, commonly gray or canescent, neither glandular nor punctate, the leaflets lineolate both sides, brighter green above than below, those of early leaves often glabrous above or on both sides but always ciliolate, those of later leaves, sometimes of all, pubescent both sides, the inflorescences silky-hirsute; *leaf-spurs* 0.2–1 mm long; *stipules* lanceolate or lance-acuminate, (1) 1.5–3.5 mm long, purplish-castaneous becoming papery, thinly strigulose dorsally, the margins sometimes charged with a few minute processes; *intra-* and *post-petiolular glands* 0; *leaves* 1–3 cm long, shortly petioled, with subterete rachis and (4) 5–12 (17) pairs of obovate to oblong-obovate, retuse, commonly folded, sometimes obtusely gland-tipped leaflets 1.5–7 mm long; *peduncles* 0.3–3 cm long; *racemes* when young lanceolate in outline becoming narrowly oblong, the flowers early declined, 2–3-ranked when pressed, without petals (10) 11–14 mm diameter, the pilosulous axis (1) 1.5–6.5 cm long; *bracts* early deciduous, narrowly lanceolate or lance-acuminate, 2.5–4 mm long, livid or castaneous becoming papery, thinly pilosulous but glandless dorsally, the margins sometimes gland-spurred; *pedicels* 0.3–0.6 mm long, glandless at apex; *calyx* at anthesis 5.2–7 mm long (slightly accrescent thereafter), silvery-hirsutulous with lustrous hairs up to 0.65–1.1 mm long, the tube 1.8–2.5 mm, the ribs slender, pallid or castaneous, becoming prominent, the finally recessed, membranous intervals charged with 1 row of ± 5 elliptic glands, the teeth lance-elliptic, herbaceous, finely net-veined, slightly unequal, the dorsal one

longest, 3.2–5.1 mm long, the ventral pair shortest but hardly broader than the rest; *petals* (tardily deciduous) bicolored, whitish-flesh-colored and dull blue or brownish purple, the banner blade margined (at base or all around) and the inner margins of wings and keel striped lengthwise with the deeper color, the banner (and sometimes the keel-blade) charged with a few small glands, the wings and keel inserted 1 mm or less beyond the hypanthium rim; *banner* 3.7–5 mm long, the claw 2–2.8 mm, the deltate-cordate and acutish or reniform and emarginate blade 2.2–3.3 mm long, 3.2–4.4 mm wide; *wings* 4.5–6.3 mm long, the claw 1.5–2.1 mm, the obliquely ovate blade 3.3–4.2 mm long, 2.1–2.8 mm wide; *keel* 6.3–9.4 mm long, the claws (1.6) 2–3.8 mm, the broadly ovate or obovate blades 4.3–5.8 mm long, 3–3.7 mm wide; *androecium* 10-merous, ± 7–8 mm long, the longer filaments free for 2.5–3 mm, the connective gland-tipped, the anthers pale bluish, 0.7–1 mm long; *pod* 2.6–3 mm long, obliquely obovate in profile, the style-base terminal but eccentric, the papery valves pilosulous, charged with 2 subvertical gland-crescents; *seed* ± 2 mm long (little known).—Collections: 22 (ii).

Open stony hillsides in arid grassland, ascending into the oak-belt, mostly between 1200 and 1770 m (± 4000–5900 ft), local but forming colonies, best known and most often collected from round the eastern margins of the Sonoran Desert, on the upper Gila River and its affluents in s. Arizona (Pinal, Pima, Cochise, Graham, Sta. Cruz counties) and adjoining s.-w. New Mexico (Grant County) and n. Sonora (Mpos. Santa Cruz and Bacoachic); apparently isolated in w.-centr. Chihuahua (environs of Ciudad Chihuahua), but the full range in Mexico probably not yet documented; reported (Rydberg, 1919, p. 62) from Nuevo León, but no specimens found.—Flowering primarily in spring, April into early June, sometimes again following summer or fall rains.—*Representative*: ARIZONA: *Gould & Pultz 3096* (NY, UC); *Maguire 11,186* (NY); *Harrison & Kearney 6671* (UC). NEW MEXICO: *Maguire 11,603* (NY, UC); *Ripley & Barneby 11,179* (CAS, NY). SONORA: *Bigelow, Mex. Bound Surv. 221a* (NY); *Wiggins 11,725* (SD, TEXU). CHIHUAHUA: *Pringle 1133* (F, MEXU), *3040* (F, NY).

Marina calycosa (Gray) Barneby, comb. nov., based on *Dalea calycosa* (with large calyces) Gray, Pl. Wright. **2**: 40. 1853.—"Hills near the Deserted Rancho, on the San Pedro, Sonora [now Arizona]; Sept. (994)."—Holotypus, collected in 1851 by Charles Wright, GH! isotypi, NY, UC!—*Parosela calycosa* (Gray) A. Hell., Cat. N. Amer. Pl., ed. 2, 5. 1900.

This delightful little species together with the closely related but geographically disjunct *M. orcuttii* is distinguished from all *Chrysorrhizae* in northern Mexico by its nodding flowers and from all members of the genus so far as known in the subterranean points of renewal on the caudex. With the exception of *M. parryi*, a plant of the Sonoran Desert distinguished by strongly warty stems and open racemes of small ascending flowers, it is the most northern *Marina*, inhabiting a region where light frost and some snow must be expected every winter, and this may account for the retreat below ground level of the buds from which growth starts in spring. Another unique feature of *M. calycosa* is the lack of post-petiolular glands, and the absence or extreme reduction of glands on the stems and dorsal face of the leaflets. The only other member of ser. *Chrysorrhizae* other than *M. orcuttii* characterized by early nodding flowers is the southern Mexican *M. procumbens*, of which the flexuously humifuse stems arise from a superficial root-crown and bear many prominent glands mixed with coarse spreading hairs. The nearest, but not really close relative of *M. calycosa* and *M. orcuttii* is *M. alamosana*. Features common to the three are smooth stems and conspicuously long, plane, herbaceous calyx-teeth, but *M. alamosana* differs from *M. calycosa* in the position of the root-crown, and in having prominent glands behind the petiolules, and from both *M. calycosa* and *M. orcuttii* in the spreading-ascending flowers. The calyx of *M. alamosana*, due to elongation of the dorsal tooth, is more asymmetric than that of *M. calycosa* and its flower is substantially smaller. The differences in habit can be seen in Plates XIII and XIV.

12. Marina orcuttii (Watson) Barneby
(Plate XIV)

Slender, decumbent, perennial herbs from a woody taproot and short caudex, strigulose nearly throughout with fine, appressed hairs up to 0.2–0.3 mm long, the simple or commonly (subbasally or distally) few-branched, pallid or pink-tinged, smooth, terete, eglandular stems 1–3.5 dm long, the foliage greenish-cinereous, the folded leaflets lineolate both sides, pubescent and gland-tipped beneath, glabrous above; *leaf-spurs* 0.3–0.6 mm long; *stipules* castaneous, becoming dry and fragile, subulate to triangular-subulate, 0.4–1.3 mm long; *intrapetiolular gland* 0; *post-petiolular glands* very small, sometimes impressed or obsolete; *main cauline leaves* (the lower drought-deciduous) 8–30 mm long, shortly petioled, with (3) 4–12 pairs of obovate to oblanceolate, obtuse leaflets (1.5) 2–5 mm long, charged dorsally around the margins with a row of small, sometimes scarcely visible glands; *peduncles* leaf-opposed, slender, incurved distally, (1) 1.5–3.5 cm long; *racemes* moderately dense, ovoid becoming oblong, without petals 8–9 mm diam, the flowers early nodding, the axis at length (0.5) 1–2.7 cm long; *bracts* herbaceous early becoming papery and deciduous before anthesis, lance-ovate beyond the cuneate base, 1.8–2.5 mm long, the margins gland-spurred; *pedicels* 0.2–0.4 mm long; *calyx* 4.2–5 mm long, hirsutulous with spreading-ascending, straight hairs up to 0.45–0.6 mm long, the tube 1.7–2.2 mm long, its membranous intervals charged with a single row of small glands extending well beyond the sinuses of the teeth, the plane, herbaceous teeth ± unequal, the lanceolate dorsal one longest, 2.1–3.1 mm long, the ventral pair slightly to decidedly shorter, 2–2.3 mm long; *petals* bicolored, the banner blade margined with lilac, pale and gland-sprinkled medially, the inner petals pale in outer half, lilac-striped in inner half, eglandular; *banner* 2.6–3.3 mm long, the claw 1.6–1.9 mm, the reniform to transversely oblong-cordate blade 1.3–1.8 mm long, 2.2–2.6 mm wide; *wings* 2.9–3.7 mm long, the claw 0.5–1.6 mm, the blade 2.6–3 mm long, 1.3–1.8 mm wide; *keel* 4.9–5.5 mm long, the claws 1.4–1.8 mm, the blades 3.6–4.1 mm long, 2.4–2.7 mm wide; *androecium* 10-merous, 4.5–5.2 mm long, the longer filaments free for 1.6–1.9 mm, the connective gland-tipped, the pinkish anthers 0.5–0.8 mm long; *pod* ± 3 mm long, essentially as in *M. calycosa.*

This rare species, endemic to three (possibly four) mountain ranges rising from the western margins of the Sonoran Desert, is the only marina known from this region that is characterized by nodding flowers. It is closely related to *M. calycosa* of the northern Sierra Madre Occidental, from which it differs principally in its superficial root-crown, smaller flowers, and evidently though sometimes only faintly gland-sprinkled dorsal face of the leaflets. It has been confused with *M. peninsularis* (as by Bullock, 1939, p. 197, who cited a paratype at K) which has flowers of about the same size but hirsutulous, prominently glandular stems, ascending flowers, and magenta-violet petals, and is found at much lower elevations on the desert floor.

The known range of *M. orcuttii* is highly restricted and discontinuous, with two small foci in California and in Sierra Juárez close below the boundary, the third in Sierra de las Palmas, distant about 680 km air-line southeastward down the peninsula. The populations in these mutually remote localities are slightly differentiated and seem to deserve taxonomic recognition.

Key to the Varieties of *Marina orcuttii*

1. Stems 1–1.5 (2.5) dm long; leaflets of main cauline leaves 5–8 pairs; Sierra Juárez and Sta. Rosa Mts., 31° 30′–33° 30′ N. 12a. var. *orcuttii*.
1. Stems 2.5–3.5 dm long; leaflets of main cauline leaves 8–12 pairs; Sierra de las Palmas near lat. 27° (and perhaps also Sierra San Borja near 29°) N lat. 12b. var. *campanea*.

12a. MARINA ORCUTTII (Watson) Barneby var. ORCUTTII (Plate XIV)

Stems short and slender, mostly less than 1.5 dm long; *leaflets* up to 8 pairs; *postpetiolular glands* obscure. — Collections: 10 (o).

Gravelly hillsides, in chaparral and pinyon or Jeffrey pine forest, 1050–1725 m, very local, known only from Sierra Juárez in n. Baja California and Santa Rosa Mts. in interior Riverside Co., California. — Flowering May to October. — *Representative*: CALIFORNIA: Deep Canyon; Riverside Co., *Zabriskie 850* (NY). BAJA CALIFORNIA (Edo): Big Canyon, Cantillas (= Tanquillas) Mts, *Palmer 66 in 1875* (GH, NY, UC). Laguna Hanson, *Wiggins 16,705* (IA, NY). Portezuelo de Jamau, *Moran 13,042* (SD, NY), *18610* Cerro Chichi de la India, *Moran 15,554* (NY, SD). Rancho Viejo, *Moran 18,097* (SD).

Marina orcuttii (Wats.) Barneby, comb. nov., based on *Dalea orcuttii* (Charles Russell Orcutt, 1864–1929) Wats., Proc. Amer. Acad. **20**: 359. 1885. — "At Topo and in the Canon Cantillas, Lower California; collected by C. R. Orcutt, in October, 1882, and July, 1884." — Lectotypus, collected by Orcutt Oct 7, 1882, GH! isotypi, F, SD (hb. Cleveland.), UC, US! paratypi, collected in 1884, GH, NY! — *Parosela orcuttii* (Wats.) Parish, Bot. Gaz. **55**: 305. 1913.

12b. MARINA ORCUTTII (Watson) Barneby var. CAMPANEA Barneby

Stouter than var. *orcuttii*, the stems reaching 3.6 dm; *leaflets* up to 12 pairs; *postpetiolular glands* small but prominent. — Collections: 2 (o).

Arid grassland, with *Nolina*, on volcanic bedrock, near 1400 m, known certainly only from the summits of Sierra de las Palmas, near lat. 27° N in northern Baja California Sur, perhaps also in Sierra San Borja near lat. 29° N in adjoining Baja California Norte. — Flowering March–April. — *Material*: BAJA CALIFORNIA (Sur): Sierra de las Palmas, s. of Santa Rosalía, *F. Torres in 1968* (ENCB, p.p.).

Marina orcuttii (Wats.) Barneby var. **campanea** (of the type-locality) Barneby, var. nov., a var. *orcuttii* caulibus magis robustis 3.5 dm usque longis, foliolisque magis numerosis 8–12 (nec 5–9)-jugis absimilis. — BAJA CALIFORNIA (Sur): La Champagna, Sierra de las Palmas, s. of Santa Rosalía Apr 27–29, 1952, *H. S. Gentry & W. B. Fox 11,807*. — Holotypus, MICH; clastotypus (fragm), NY.

In addition to the collections cited I have seen a small one labelled "San Enrique, *Brandegee*, 1889" (UC) which I identified as *M. orcuttii* before the separation of var. *campanea* had been realized. Not having reexamined it, I cannot now be sure of its identity. Accord-

ing to Moran (Madroño **11**: 254), San Enrique must be ± 30 km south of San Borja in lat. ± 28° 30′ N, that is in the western foothill country bordering Sierra San Borja. This sierra rises to near 1650 m and could well provide a habitat for *M. orcuttii* on its upper slopes.

13. Marina procumbens (Mociño & Sessé ex De Candolle) Barneby (Plate XII)

Perennial, herbaceous or feebly suffrutescent at base, the flexuously humifuse, radiating, irregularly branched stems (1) 1.5–5 dm long, pink- or brown-purple, pilosulous and gland-tuberculate throughout or at least above the middle, the hairs spreading or subdeflexed, up to 0.3–0.5 mm long, the foliage glabrous or subglabrous, yellow-green or purple-suffused, the leaflets lineolate both sides, often minutely gland-punctate beneath, the margins usually gland-crenulate; *leaf-spurs* 0.3–1 mm long; *stipules* broadly triangular to narrowly subulate, firm, glabrous dorsally, ciliolate, 0.8–2 mm long; *intrapetiolular gland* subulate; *post-petiolular glands* similar, ± 0.2–0.4 mm long; *main cauline leaves* 1.5–3 cm long, shortly petioled, with very narrowly margined, thinly pilosulous or glabrous rachis and 6–10 pairs of oblong-obovate or obovate, obtusely or subacutely gland-tipped, flat or shallowly boat-shaped leaflets 1.5–4.5 mm long, the rameal leaves mostly shorter, with usually fewer (5–7 pairs) of smaller leaflets; *peduncles* relatively stout, mostly leaf-opposed, 1–2 cm long; *racemes* incurved to vertical, rather closely 15–40 (50)-flowered, the early nodding flowers subcontiguously 2–3-ranked when pressed, without petals ± 9–10 mm diam, the pilosulous axis becoming (1) 1.5–5 cm long; *bracts* caducous (sometimes tardily), ovate or lanceolate, 1.5–2.8 mm long, membranous becoming papery and brown, ciliolate, microglandular dorsally; *pedicels* rather stout, ascending and then curved outward, 0.4–0.8 (1) mm long, charged above middle with a pair of glands; *calyx* (3.4) 4–4.7 mm long, pilosulous externally (and sometimes thinly so within the orifice) with spreading-incurved, stiffish hairs up to 0.25–0.4 mm long, the pleated tube 1.7–2.7 mm long, the recessed, pallid but firm intervals charged with one row of 3–5 (6) glands, the ovate or lance-ovate teeth a little unequal, the dorsal one longest, (1.7) 1.9–2.5 mm long, the ventral pair broadest and shortest, the plane, herbaceous tips of all spurred marginally with 1–3 glands on either side, sometimes incipiently dentate, the dorsal sinus a trifle shallower than the lateral ones; *petals* bicolored, the gland-sprinkled banner whitish, faintly rubescent in age, the inner ones perched ± 1–1.3 mm above hypanthium rim, pink with purple band or patch along the inner margins, the keel-blades gland-sprinkled; *banner* ± 3.2–4.2 mm long, the claw 1.3–1.5 mm, the transversely oblong or oblong-reniform blade recessed behind the top of claw into a cornet, ± 1.6–2.2 mm long, 3.2–4 mm wide; *wings* 3.6–4.5 mm long, the claw 0.7–1.2 mm, the broadly obovate blades 3.1–4.2 mm long, 2.1–2.4 mm wide; *keel* 4.4–5.8 mm long, the claws 1–1.6 mm, the obliquely ovate blades 3.4–4.5 mm long, 2.5–3.2 mm wide; *androecium* 10-merous, 5.2–6.2 mm long, the longer filaments free for 1.7–2.2 mm, the connective gland-tipped, the bluish anthers 0.45–0.8 mm long; *pod* harp-shaped in profile, ± 3 mm long, membranous at very base only, firm, smooth and glabrous in the lower ⅓, thinly pilose and somewhat rugulose distally, the faces charged with 2 subvertical gland-crescents; 2n = 20 (Mosquin). — Collections: 18 (iv).

In thin stony or chalky soils or low hills and canyon terraces, in arid grassland, 780–2020 m (± 2600–6730 ft), local but forming colonies, widely but discontinuously

dispersed over s. Mexico: Bajío and Lerma-Santiago valley in Guanajuato, n. Michoacán, and Jalisco, in Jalisco extending w. to Etzatlán, n. in the drainage of Río Atengo to Huejuquilla El Alto (to be sought in adjoining Zacatecas and possibly Nayarit), and s. on Río San Pedro to the s. slope of the Transverse Volcanic Belt; unknown as yet from w. Balsas Depression, but present in its e. arm in Morelos and Guerrero; highlands of n.-centr. Oaxaca; valley of Río Grande de Chiapas, Chiapas (Venustiano Carranza). — Flowering June to November (but apparently not into the winter months as most sympatric species of *Marina*). — *Representative*: JALISCO: *Pringle 8771* (F, M, MEXU, NY, UC, W, Z); *Rose 2525* (MEXU, NY, US); *McVaugh 18,549* (MICH), *21,955* (MICH). GUANAJUATO: *Kenoyer 1852* (GH). MICHOACÁN: *Arsène in 1910* (F). MORELOS: *Pringle 8521* (F, M, MEXU, NY, UC, W, Z). OAXACA: *Gentry 12,112* (MEXU), *12,262* (MICH); *Ripley & Barneby 13,640* (MEXU, NY, US), *13,650* (CAS, NY), *13,651* (NY, US). CHIAPAS: *Laughlin 1640* (US).

Marina procumbens (Moc. & Sessé ex DC.) Barneby, comb. nov., based on *Dalea procumbens* (prone, of the stems) Moc. & Sessé ex DC., Prod. **2**: 246. 1825. — "...in Mexico ad Chilapae circuitus [Guerrero]..." — No specimen seen by DeCandolle, the description compiled from the lost drawing of Sessé which survives as a "calque" or tracing at G (blueprint NY)! No matching specimen survives in herb. Sessé & Moc. (cf. below). — *Parosela procumbens* (Moc. & Sessé) Rose, Contrib. U. S. Nat. Herb. **8**: 304. 1905 (apr) and in Rose & Painter, Bot. Gaz. **40**: 144. 1905 (aug).

Psoralea procumbens Sessé & Moc., Pl. Nov. Hisp. 120. 1889. — "Habitat prope Chilapam." — No typus known to survive. The description seems to have been designed to accompany the plate of *Dalea procumbens* described and copied by DeCandolle (cf. above), the identity of *Ps.* and *D. procumbens* confirmed by congruence of description, type-locality, and epithet.

Because it is the only member of its series yet found southward and eastward from Lerma-Santiago valley in Jalisco., *M. procumbens* is in practice easily recognized. It most nearly resembles *M. goldmani* in pubescence and petal-color, but differs in its early nodding flowers and pliantly humifuse (not stiffly diffuse) stems. These radiate from the crown of a slender root, bearing one to several leaf-opposed spikes on short incurved peduncles, the spikes themselves appearing to rise directly vertical from the ground. The growth-habit is exactly that of *Dalea prostrata*. The only sympatric marina at all similar in habit of growth is the much frailer *M. holwayi*, distinguished at a glance by its subumbellate raceme of less than ten flowers, with wing- and keel-blades vivid magenta (not pink-purple) and, at closer quarters, by the tiny glandless banner open at base of blade in the manner characteristic of ser. *Unifoliolatae*. The poorly known *M. gemmea*, which inhabits arid grassland at low elevations within the range of *M. procumbens*, is perhaps rather similar in general appearance, but has apparently stiffer, procumbently arching stems. It is however readily recognized at anthesis by the dorsally glandular calyx-teeth of which the broad ventral pair are united through about half their length, and later on by the uniformly and densely gland-pustulate faces of the pod.

DeCandolle described *D. procumbens* as annual, but as he never saw a specimen the discrepancy cannot be taken seriously. No specimen collected by Sessé seems to have survived, and the species has not been collected since in Guerrero, although known to occur about 100 kilometers north from Chilapa in Morelos (Puente de Ixtla). In the circumstances there remains some doubt as to the identity of the original, but the tracing of Sessé and Mociño's plate, supplemented by the description of *Psoralea procumbens* S. & M., which I assume to be the same, suggests the species here treated more than any other known from southern Mexico. I therefore accept the traditional interpretation of *D. procumbens* S. & M. ex DC., first established by Rose and followed by Rydberg (1919, p. 52).

14. Marina peninsularis (Rose) Barneby

(Plate XV)

Potentially perennial but precociously flowering and of short duration, with thin, orange-yellow taproot, variable in vigor and stature, when depauperate with one central, erect and two lateral, incurved short stems, but more often many-stemmed, diffuse or prostrate, forming circular mats up to 5–18 dm diam, pilosulous throughout with widely spreading, spreading-incurved, or subdeflexed, stiff white hairs up to 0.2–0.35 mm long, the stems terete, stramineous, prominently verruculose with protuberant or grainlike, mostly livid glands, simple only when short, usually branched irregularly and repeatedly, floriferous upward from below or near middle, the foliage greenish or ashen, the leaflets obscurely lineolate above, livid- or orange-punctate beneath, pilosulous both sides; *leaf-spurs* subobsolete; *stipules* subulate to lance-acuminate, 0.7–2 mm long, thinly herbaceous becoming brown and papery, fragile, deciduous, charged at base with a pair of brown glands; *intrapetiolular gland* small; *post-petiolular glands* large and prominent, mammiform or prickle-shaped; *leaves* (0.6) 1–2.5 (3) cm long, subsessile or very shortly petioled, with narrowly margined, gland-charged rachis and (3) 4 –7 (8), exceptionally 6–10 pairs of obovate, obcordate, or oblong-obovate, emarginate, bluntly gland-tipped, loosely folded leaflets (1.5) 2–4.5 (5) mm long; *peduncles* (all leaf-opposed) incurved-ascending, 1–3.5 (5) cm long; *racemes* moderately dense, the ascending flowers ± 3-ranked when pressed, without petals 5–6.5 mm diam, the thinly pilosulous axis (0.6) 1–2.5 cm long; *bracts* deciduous, lanceolate or ovate, 1.1–2.5 mm long, thinly herbaceous, gland-tipped, the margins usually charged with a few orange glands; *pedicels* 0.2–0.5 mm long, charged at base and under calyx with a pair of fusiform, orange glands; *calyx* (2.6) 2.8–3.8 mm long, pilosulous (as the foliage) from base upward, the tube 1.3–1.7 (1.8) mm, pleated, the slender, yellowish ribs becoming prominent, the orifice a little oblique but not recessed dorsally, the sunken, membranous intervals with a chain of (4) 5–7 small, elliptic, pale yellow or hyaline glands, the herbaceous teeth unequal, the lanceolate dorsal one (1.3) 1.5–2.3 mm long (0–0.8 mm longer than tube), the ventral pair a little shorter and relatively broader, ovate-lanceolate, all gland-tipped; *petals* bright magenta-purple except for the yellow, gland-charged eye-spot on the banner, the inner petals perched 0.7–1.2 mm above hypanthium rim, their blades eglandular (or the keel with 1–2 minute glands), pale along exterior edges; *banner* 2.7–4 mm long, the claw 1.2–1.7 mm, the reniform-cordate, truncate or very obtuse blade 1.6–2.6 mm long, 2–3.4 mm wide; *wings* 2.6–3.2 mm long, the claw 0.2–0.8 mm, the obovate, shortly auricled blade 2–3 mm long, 1.3–1.9 mm wide; *keel* (3.2) 3.5–4.7 mm long, the claws (0.7) 1–1.4 mm, the broadly obovate blades (2.7) 2.9–3.7 mm long, (1.7) 2–2.8 mm wide; *androecium* 10-merous, (3.7) 4–5.3 mm long, the longer filaments free for 1.4–1.9 mm, the connective gland-tipped, the pale anthers 0.45–0.7 mm long; *pod* obovate in profile, 1.7–2.2 mm long, the style-base terminal but eccentric, the prow prominent but very slender, the valves hyaline in lower half, thinly papery and pilosulous distally, charged with 2 vertical gland-crescents; *seeds* 1.2–1.4 mm long, ochraceous; n = 10 + 1 fragm (Spellenberg, 1973).

Dunes and sandy desert flats and washes, mostly below 150 m (500 ft), locally plentiful in favorable seasons, Vizcaíno Desert s. on the Pacific slope of Baja California Sur to the Llanos de Magdalena and on the Gulf slope to Bahía La Paz, in lat. 24–28° N. (reaching slightly n. of lat. 28° near El Arco and Calmallí, hence just entering Baja California Norte), on the Gulf coast extending out onto the sea dunes and reappearing in the same habitat across the Gulf in s. Sonora (near Yavaros) and

n.-centr. Sinaloa (Topolobampo; Altata). — Flowering November to April. — *Representative*: BAJA CALIFORNIA (Norte); *Harbison 41,564* (SD). BAJA CALIFORNIA (Sur); *Wiggins 16,818* (NY); *Gentry 7591a* (ARIZ, UC); *Shreve 7136* (ARIZ, F); *Wiggins 5517* (ARIZ, NY, UC); *Carter, Alexander & Kellogg 2126* (MEXU, UC), *2473* (MEXU, UC); *Gentry 4200* (ARIZ, UC); *Wiggins 14,661* (MEXU, UC). SONORA: *Gentry 6772* (NY). SINALOA: *Gentry 5450* (ARIZ); *Ockendon 64/7* (TEX).

Marina peninsularis (Rose) Barneby, comb. nov., based on *Parosela peninsularis* (of Baja California) Rose, Contrib. U. S. Nat. Herb. **8**: 304. 1905, a substitute for *Dalea canescens* (growing white, of the gray pubescence) Benth., Bot. Sulphur 12. 1844, a later homonym (non *D. canescens* M. & G., 1843). — "Bay of Magdalena." — Holotypus, collected in November 1839 by George Barclay, plant collector on cruise of H. M. S. 'Sulphur', K (herb. Benth.)! isotypus (*Barclay 3121*), BM. — *Dalea peninsularis* (Rose) Bullock, Kew Bull. **1939**: 197. 1939.

This species, *M. peninsularis*, together with *M. interstes* and *M. chrysorrhiza* form a small cluster of *Chrysorrhizae* native on dunes and other sandy desert soils through the length of Baja California Sur, where they succeed each other in a replacement series going north to south. Their collective range extends over the south lobe of that of *M. parryi* and on through the lowland segment of that of *M. divaricata*, from both of which they differ in being slender, precociously flowering herbs with pliantly diffuse, never stiff or suffruticose stems, and in the small flowers (the keel-blades mostly ± 2.5–3 mm long). The commonest of the trio is *M. peninsularis*, widespread from the Vizcaíno Desert to the latitude of La Paz, where its range abuts on that of the related but much more local *M. interstes*. For differential characters of this last, see under the next entry. From the allopatric *M. chrysorrhiza*, endemic to the Cape region, *M. peninsularis* differs in its slightly fewer (mostly 4–8 not 8–11) pairs of membranous (not thick and glaucescent) leaflets charged dorsally at tip with a relatively small gland (0.1–0.2 not 0.3–0.4 mm long) and in its relatively well-furnished racemes of mostly 10–25 (not 4–12) flowers. The stems of *M. peninsularis*, which vary greatly in length with age and season (0.4–9 dm), are usually pilosulous their whole length and also verruculose with prominent, often grainlike glands. However, in the isolated population from coastal Sonora (known only from young specimens) these glands are apparently almost lacking.

A specimen (*Orcutt 637*) from Topo, in Sierra Juárez far north of the known limit of *M. peninsularis*, was referred here by Bullock (1939) when he transferred *Parosela peninsularis* to *Dalea*. I suppose the plant (which I inadvertently missed at K) must represent *M. orcuttii*, the only marina known from Sierra Juárez, different in vesture, nodding flowers, and proportions of the calyx.

15. MARINA INTERSTES Barneby

(Plate XV)

Slender annual herbs with the habit of *M. peninsularis*, strigulose-pilosulous nearly throughout with forwardly subappressed or incumbent hairs up to 0.25–0.4 mm long, the 3-many stems prostrately radiating from the crown of a yellow taproot, (0.5) 1–6 dm long; repeatedly forking from near base upward, greenish or purple-tinged, sparsely low-tuberculate distally, floriferous nearly throughout, the foliage green or greenish-cinereous, the leaflets lineolate both sides, thinly pilosulous both sides or often glabrescent above, minutely or obsoletely punctate beneath; *leaf-spurs* almost 0; *stipules* lance-acuminate or subulate, 0.2–2 (2.5) mm long, brown or livid, becoming dry and deciduous, thinly ciliolate, gland-tipped; *intra-* and *post-petiolular glands*

prominent, rounded or pointed; *main cauline leaves* 1–2.3 (2.7) cm long, very shortly petioled, with subfiliform, ventrally grooved but scarcely winged rachis and 4–8 (mostly 5–7) pairs of oblong-obovate, -oblanceolate, or narrowly obovate, emarginate, flat or loosely folded leaflets 1.5–4.5 (7.5) mm long, all charged dorsally at apex with a prominent gland 0.1–0.15 mm long; *peduncles* leaf-opposed, 2–30 mm long; *racemes* rather loosely 8–18-flowered, the flowers ascending, the very slender but stiff rachis becoming (0.6) 1–2.5 cm long; *bracts* deciduous, narrowly ovate-acuminate or lanceolate, 1.2–1.5 mm long, green, thinly pubescent dorsally, charged on back and margins with a few glands; *pedicels* 0.3–0.5 mm long, glabrous, charged at apex with 2 grainlike glands; *calyx* 2.1–2.8 mm long, pilosulous externally from base upward with incurved-ascending hairs 0.15–0.25 mm long, the tube 1.1–1.4 mm long, the recessed intervals charged with a chain of 4–7 small glands (as *M. peninsularis*), the teeth unequal, the dorsal one longest, oblanceolate, 1–1.4 mm long; *petals* bicolored, half blue or blue-purple, half creamy, the banner with a pallid, gland-sprinkled eye-spot, the wings and keel perched at 0.6–1.2 mm above hypanthium rim, striped lengthwise (pale along outer edges), the keel gland-sprinkled; *banner* 2.3–2.5 mm long, the claw 1.1–1.3 mm, the transversely oblong-reniform blade with small recessed acumination at tip, 1.2–1.4 mm long, 2.1–2.5 mm wide; *wings* 2.4–2.7 mm long, the claw 0.5–0.7 mm, the blade 2.1–2.3 mm long, 1.2–1.3 mm wide; *keel* 3.2–3.8 mm long, the claws 0.7–1.2 mm, the blades 2.3–2.8 mm long, 1.6–2.2 mm wide; *androecium* 10-merous, 3.4–4 mm long, the longer filaments free for 1.1–1.2 mm, the connective gland-tipped, the pallid anthers 0.3–0.35 mm long; *pod* as in *M. peninsularis*, the faces charged with 2 well-defined gland-crescents. — Collections: 12 (o).

Rocky hillsides and beds of sandy arroyos, ± 5–450 m, apparently local, known only from the neighborhood of La Paz and within a radius of ± 35 km s.-e., s., and n.-e. of the city, in mpos. La Paz and San Antonio, Baja California Sur. — Flowering October to March. — *Material*: BAJA CALIFORNIA (Sur): La Paz, *Brandegee in 1890* (UC), *Jones 24,336* (F, POM, UC), *24,337* (UC), *24,335* (ARIZ). 8 mi n.-e. of La Paz, *D. M. Porter 381* (MEXU, UC). 2 mi e. of La Paz, *S. S. White 5027* (MICH). 6 mi e. of La Paz, on El Coyote rd, *Wiggins 15,713* (UC). 18.5–19 mi s.-e. of La Paz on Los Planes rd, *D. M. Porter 264* (MEXU), *Wiggins 14,395* (MEXU, UC). 10 mi s.-e. of La Paz, *Wiggins, Carter & Ernst 452* (UC). 23 mi s. of La Paz (typus). 1.5 mi s.-w. of La Paz, *Wiggins 15,713* (UC).

Dalea interstes (intermediate, morphologically and geographically, between two allies) Barneby, sp. nov., inter *M. peninsularem* et *M. chrysorrhizam* quasi intermedia, illi propior et quoad foliolorum numerum, ambitum texturamque necnon racemum pluriflorum (nec subumbellatum) simillima, sed caulibus laevibus vel subeverruculosis parce strigoso-pilosulis (nec pilis erectis retrorsisque hispidulis), calyce corollaque minoribus, petalisque coeruleo-purpureo-maculatis nec vivide saturate vinaceis absimilis. — BAJA CALIFORNIA (Sur): sandy soil about 23 miles s. of La Paz along road to Todos Santos, November 2, 1959, *Ira L. Wiggins 15,285*. — Holotypus, UC.

Material of *M. interstes* has reached herbaria under the names *Dalea peninsularis, D. chrysorrhiza*, and *D. holwayi*. It resembles all these in general aspect but is clearly nearest the first two, and in some (but not all) respects intermediate between them. Characters suggesting *M. peninsularis* are the relatively few membranous, not thickened and glaucescent leaflets and the racemes of generally more than ten flowers; while the small size of the flower and the short androecium lean toward *M. chrysorrhiza*. The new species differs from both these kindred in the subappressed vesture of the stems, which almost lack the prominent warty glands characteristic (at least in its peninsular range) of *M. peninsularis*.

Field notes describe the fresh flower of *M. interstes* as blue or purplish blue, a color range quite different from the vivid magenta purples of *M. peninsularis*; and the difference is maintained in dried material. The range of *M. peninsularis* extends south just to Bahía La Paz, and near Los Aripes, for example, it must occur in close proximity to *M. interstes*. It seems probable that the two species are ecologically separated, however, *M. peninsularis* being adapted to dune conditions, and *M. interstes*, so far as records go, to stream beds and stony ground.

16. Marina chrysorrhiza (Gray) Barneby
(Plate XVI)

Very slender, annual or perhaps short-lived perennial herbs, delicate and sparsely leafy, appearing glabrous below the inflorescence but some stipules distally and commonly also the young stems, some leaf-rachises, and the peduncles thinly pilosulous with a few fine, rather stiff, spreading and incurved-ascending hairs up to 0.25–0.45 mm long, the foliage subglaucescent, thick-textured, the leaflets punctate and either quite glabrous or thinly pilosulous beneath, finely lineolate above; *stems* usually numerous, prostrately radiating from the root-crown, 1–7 dm long, simple when short but usually branched, rarely solitary and suberect and then diffusely branched distally, stramineous or purplish-castaneous, sparsely charged with low blister-glands, sometimes almost smooth, floriferous upward from near or below the middle; *leaf-spurs* almost 0; *stipules* narrowly ovate to lanceolate, 0.8–2.1 mm long, flat, thinly herbaceous, glabrous and obscurely glandular dorsally, ciliolate, gland-tipped; *intrapetiolular gland* small; *post-petiolular glands* prominent, usually orange; *leaves* 8–35 mm long, shortly petioled, with scarcely winged rachis and (4) 6–12 pairs of linear-oblanceolate to narrowly oblong-obovate, retuse, ± involute or folded leaflets 1–4 mm long, all charged dorsally at or just below apex with a large yellow or orange gland; *peduncles* numerous, leaf-opposed, subfiliform, 0.5–2.5 cm long; *racemes* loosely but shortly 4–8 (11)-flowered, the glabrous or sparsely pilosulous axis 3–11 mm long; *bracts* early deciduous, ovate or elliptic, 1.2–2 mm long, thinly herbaceous, glandular and subglabrous dorsally, ciliolate; *pedicels* 0.3–0.5 mm long, charged at base and above middle with a pair of fusiform orange glands; *calyx* at anthesis 2.3–3 mm long (slightly accrescent thereafter), the tube 1–1.3 mm long, either densely or quite thinly pilosulous along the eventually prominent ribs with spreading and upwardly incurved hairs, the narrow, recessed intervals charged with a chain of ± 5–6 small, honey-colored glands, the herbaceous teeth narrowly oblong-oblanceolate, gland-mucronulate, incurved-ciliolate, the dorsal one 1.3–2 mm long, the rest a trifle shorter; *petals* bicolored, the banner with a small, yellow, gland-sprinkled eye-spot in the purple blade, the wings and keel vivid purple in inner half, pallid externally, these perched not over 1 mm above hypanthium rim, the blades of the keel sometimes thinly gland-sprinkled; *banner* 1.6–2.6 mm long, the claw 1.2–1.5 mm, the suborbicular-reniform, sometimes angulate blade 1.2–1.7 mm long, 1.6–2.4 mm wide; *wings* 2.5–3 mm long, the claw 0.5–0.6 mm, the oblong-obovate blades 2.1–2.7 mm long, 1–1.5 mm wide; *keel* (2.7) 3.3–4.5 mm long, the claws (0.9) 1–1.6 mm, the obovate-elliptic blades (1.8) 2.2–3 mm long, 1.4–1.9 mm wide; *androecium* 10-merous, 3.2–3.7 mm long, the connective gland-tipped, the anthers 0.35–0.5 mm long; *pod* 1.8–2 mm long, obliquely triangular-obovate in profile, the style-base strongly eccentric, the prow prominent but subfiliform, the valves hyaline in lower half, thence papery, thinly pilosulous, and charged with 2 subvertical gland-crescents; *seed* (little known) ± 1.6 mm long, olivaceous. —Collections: 9 (o).

Habitat not recorded, to be sought in open sandy ground at low elevations but apparently not along the immediate shoreline, local, known from scattered stations through the Cape region of Baja California Sur, between La Paz and Cabo San Lucas, on both slopes but seemingly more abundant on the Gulf side, in mpos. La Paz, San Antonio, Santiago, and San José del Cabo. — Flowering August to February, also May, perhaps intermittently through the year. — *Material*: BAJA CALIFORNIA (Sur): region of La Paz, *Palmer 71 in 1890* (F, MEXU, NY), *Gander 9778* (SD). 7 mi s. of Miraflores, *Gander 9761* (SD). La Palma, *Brandegee in 1902* (UC). El Taste, *Brandegee in 1902* (UC). San José del Cabo or Todos Santos to La Paz, *Brandegee 126* (F, NY). San José del Cabo, *Purpus 299* (UC). Cabo San Lucas (typus).

Marina chrysorrhiza (Gray) Barneby, comb. nov., based on *Dalea chrysorrhiza* (with golden root, a feature common in the genus) Gray, Proc. Amer. Acad. **5**: 156. 1861. — "...at San Lucas and the vicinity...*L. J. Xantus No.* 22..." — Holotypus, collected late in 1859 or early in 1860, US! isotypi, GH, NY! — *Parosela chrysorrhiza* (Gray) Rose, Contrib. U. S. Nat. Herb. **8**: 304. 1905.

As may be seen from the accompanying Plate XVI, *M. chrysorrhiza* rather closely resembles the southern Mexican *M. holwayi* in general facies, but differs importantly in details of the banner and pod. Its close kinship is with the more nearly, or at its northern limit marginally sympatric *M. interstes* and *M. peninsularis*; from these it differs in the few-flowered racemes, the glaucescent leaflets tipped on the back with an exceptionally large gland, and the dorsally glabrate calyx-teeth which contrast curiously with the more or less pilosulous tube. The stems of *M. peninsularis* bear the same type of spreading hairs as those of *M. chrysorrhiza*, but they are usually more numerous and more closely set and are accompanied (with rare exceptions) by strongly elevated or grainlike blister-glands, while the leaflets of most principal cauline leaves are fewer and membranous, green or at least green beneath the vesture and never at all glaucescent. Additional differential characters of *M. interstes* are the appressed stem-pubescence and the purplish-blue (not magenta) colouring of the petals.

Nothing has been learned of the habitat of *M. chrysorrhiza*, and its pattern of dispersal is poorly understood. Brandegee's locality-data as quoted above are perhaps not entirely reliable, especially so since the same field-number is associated with two localities, one of which may be incorrect. It is an unusual circumstance in *Marina* to find three closely related species occurring in the same general region, as *M. chrysorrhiza*, *M. peninsularis,* and *M. interstes* are said to do around La Paz, but this may be explained in terms of diverse ecologies. Field observation is needed.

17. MARINA EVANESCENS (Brandegee) Barneby
(Plate XVII)

Slender, sometimes diminutive herbs from an annual or feebly perennant yellow root, strigulose throughout with narrowly incurved-ascending and subappressed hairs up to 0.2–0.4 mm long, the (1) 3–many smooth, brownish-stramineous, remotely impressed-glandular or distally microtuberculate stems (0.5) 1–5 dm long, commonly diffuse or procumbent, simple or when robust irregularly branching, floriferous upward from near or above middle, the foliage green or greenish-cinereous, the thin-textured leaflets lineolate above, minutely punctate beneath, pubescent both sides or glabrescent above; *leaf-spurs* 0.4–1 mm long; *stipules* narrowly subulate-acuminate or caudate, (1) 1.5–2.5 mm long, thinly herbaceous becoming papery, castaneous, stiff and fragile; *intrapetiolular gland* minute; *post-petiolular glands* small, rounded,

orange or livid; *leaves* 1–3 cm long, shortly petioled or subsessile, with very narrowly margined rachis and (2) 3–6 (7) pairs of oblong-obovate to obovate-cuneate or obcordate, very obtuse to emarginate, flat leaflets 2–6 (7) mm long, the stalked terminal one a little longer than the last pair; *peduncles* all leaf-opposed, very slender, 0.5–6 cm long; *racemes* spiciform, moderately dense, catkin-like, 4–5 (or ultimately 6) mm diam, the thinly villosulous axis 0.5–2 cm long; *bracts* tardily deciduous, broadly oblanceolate to obovate and short-acuminate, 1.7–3 mm long, herbaceous beyond the immediate base, thinly strigulose and obscurely glandular dorsally, the margins often obscurely gland-denticulate; *pedicels* very short, at anthesis sometimes almost 0, at most 0.2 mm long, charged at apex with 2 minute glands; *calyx* 3–3.7 mm long, obovoid, strigulose with narrowly incurved-ascending hairs up to ± 0.3 mm long, the tube 1.4–2.2 mm long, a trifle recessed dorsally, shallowly pleated, the slender, pale or brownish ribs prominent, the sunken, membranous intervals charged with a chain of 4–5 narrowly elliptic, golden or pallid glands, the ovate, short-acuminate, green, minutely gland-tipped and -denticulate teeth unequal, the dorsal one longest, 1.4–1.7 mm long, the ventral pair scarcely over half as long, sometimes a trifle broader; *petals* bicolored, included in the calyx or scarcely exserted, the banner-blade white with lavender or purple basal lobes, minutely gland-sprinkled, in age rubescent, the inner pairs perched on the column just below separation of the filaments, pink or magenta-violet, the keel-blades separate even in vernation; *banner* 1.7–2.2 mm long, the claw 0.9–1.4 mm, the reniform or deltate-cordate blade 0.7–1.3 mm long, 1.1–1.5 mm wide; *wings* 1.2–1.6 mm long, the claw 0.1–0.2 mm, the oblong-obovate blade 1.1–1.5 mm long, 0.7–0.9 mm wide; *keel-petals* 1.5–2.1 mm long, the claw 0.1–0.2 mm, the obovate blades 1.4–2 mm long, 1–1.2 mm wide; *androecium* 5–6-merous, 2.8–3.6 mm long, the longer filaments free for 0.9–1.2 mm, the connective gland-tipped, the anthers 0.25–0.5 mm long, a trifle broader; *pod* ± 2 mm long, obliquely obovate in profile, the style-base terminal but excentric, the crest prominent, the prow slender, the valves hyaline at base, thence thinly papery, pilosulous, and charged with 2 subvertical gland-crescents; *seed* not seen ripe. — Collections: 13 (o).

Open rocky slopes of desert mountains, seeding down along arroyos to adobe flats and clay depressions moist following rains, there becoming stout and potentially perennant, 5–400 m, perhaps slightly higher, local in the Sonoran Desert of centr. and s. Baja California from Santa Gertrudis (± lat. 28° 5′) near the s. border of Distrito Norte s. to Sierra Giganta (lat. 25° 55′) and Isla Coronado in Distrito Sur; apparently disjunctly in the Cape region near La Paz and Todos Santos (lat. 24° 10′ to 23° 25′), and on the coast of Sonora at Guaymas (lat. 28°). — Flowering October to April, following rains. — *Material*: BAJA CALIFORNIA (Norte): Santa Gertrudis, *Purpus 136* (UC, US). BAJA CALIFORNIA (Sur); San Ignacio (4 mi e.), *Shreve 7031*; ibid. (3.3 mi s.-w.), *Wiggins 15,177* (UC); Cerros de Nancajoa w. of Llanos de San Juan, *Carter 4476* (NY, UC); 19 mi e. of Comondú, *Shreve 7031* (ARIZ, UC); s. end Isla Coronado, *Wiggins 17,476* (NY); Sierra Giganta, n.-e. of San Xavier, *Carter & Ferris 3858* (UC); hills e. of La Paz at La Laguna, *Carter 2613* (US); Todos Santos, *Jones 24,331* (F). SONORA: Guaymas, *Gentry 4699* (ARIZ, F, NY, UC), *Ripley 14,262* (ARIZ, CAS, F, GH, IA, UC, US).

Marina evanescens (Brandg.) Barneby, comb. nov., based on *Dalea evanescens* (fleeting, descriptive of the tiny petals and often of the root) Brandg., Proc. Calif. Acad. Sci. II, **2**: 146. 1889. — "...near San Ignacio." — Holotypus, collected by T. S. Brandegee, April 16, 1889, UC! — *Petalostemon evanescens* (Brandg.) Rose ex Rydb. N. Amer. Fl. **24**: 129. 1920.

The flower of *M. evanescens* is the most advanced and specialized in ser. *Chrysorrhizae*, notable for degeneration of the corolla accompanied by reduction of the androecium to five or rarely six members. Not only are the petals greatly reduced in size, but the inner ones have migrated further out along the staminal column than seen elsewhere in the series, and the keel-blades are free even in vernation, falling with the wings almost as soon as they expand. The loss of five stamens induced Rose to transfer *Dalea evanescens* to *Petalostemon*, but it has no close relationship in that direction. In all critical characters it is a typical *Marina*, with the lineolate leaflets, herbaceous calyx-teeth, and solitary ovule of its genus. It is interesting that several annual species of *Dalea* have undergone a quite similar reduction of the androecium and corolla; none of them resemble *M. evanescens* in other features, and it seems certain that the specialized flower has developed independently. Rydberg's treatment of these annual daleas and *M. evanescens* as constituting collectively a sect. *Exiles* within *Petalostemon* is phylogenetically unrealistic.

In the range of *M. evanescens* only the unique *M. vetula*, distinguished by peculiar foliage, calyx, and pod, approaches it in size or form of the petals, but this has retained at least nine of the full complement of stamens. The degeneration of the flower is such a marked departure from the norm in ser. *Chrysorrhizae* that *M. evanescens* might be considered as forming a monotypic series of its own; nevertheless the general aspect of the plant, the foliage, and especially the calyx are all so obviously of the type found in other herbaceous annual or short-lived *Chrysorrhizae* native to the deserts of Baja California, that I feel confident that all originated comparatively recently from a common stock. At the specific level *M. evanescens* is readily recognized by the syndrome of few (3–6) pairs of flat, oval, strigulose leaflets combined with little catkin-like spikes of subsessile calyces from which the fugitive petals and abbreviated androecium hardly emerge.

Brandegee described *M. evanescens* from a slender, few-stemmed, obviously annual phase such as occurs in well-drained rocky soil. Plants seeding into hollows or clay flats where water settles and evaporates more slowly develop a much greater number of diffuse, freely branching stems which can form mats of foliage up to a meter in diameter. Herbarium specimens of the more robust phase have lignescent roots which would not suggest, in North Temperate latitudes, a monocarpic lifespan. Nothing is known for certain about the longevity of *M. evanescens*, but it seems probable that seeds may germinate either in fall or spring. and that the duration of the individual plant depends less on the cycle of the seasons as such than on depth of rainfall and in particular on timing of the rains.

A(ii). Series VETULAE (Rydberg) Barneby

Desert annuals, glabrous to the silky-barbate inflorescence, the foliage glaucescent, the terminal leaflet lanceolate, 2–3 times longer than the many (10–22) pairs of suborbicular lateral ones; *calyx-teeth* lance-acuminate, 3–4 times longer than the shallow tube; *petals* all minutely gland-sprinkled, the banner much longer than the tiny, short-clawed inner petals, the keel blades free in vernation, caducous; *androecium* 9 (10)-merous; *pod* harp-shaped in profile, the style-base lateral, the papery-membranous valves charged with 1 horizontal and 1 subvertical gland-crescent. —Species 1, of s.-centr. Baja California and s.-w. Coahuila.

Marina sect. **Marina** ser. **Vetulae** (Rydb.) Barneby, comb. nov., based on *Parosela* VII. *Vetulae* Rydb., N. Amer. Fl. **24**: 61. 1919. — Sp. typica: *P. vetula* (Brandg.) Rydb. = **Marina vetula** (Brandg.) Barneby.

18. MARINA VETULA (Brandegee) Barneby
(Plate XI)

Annuals from a slender orange taproot, 1–3.5 dm tall, glabrous up to the silky-pilosulous inflorescence (some upper stipules sometimes minutely ciliolate), either simple and erect or (more commonly) with an erect central stem and 1–several incurved-ascending from near the ground, the branches simple or few-forked, floriferous from near middle upward, all smooth but remotely gland-punctate, purplish and finally pruinose at base, the foliage greenish-glaucescent, the leaflets of thick texture, lineolate both sides, minutely pallid-punctate beneath; *leaf-spurs* 0.5–1 mm long; *stipules* linear-attenuate or narrowly subulate, 1–3 mm long, greenish or livid becoming dry and fragile; *intrapetiolular gland* minute; *post-petiolular glands* small, immersed or barely prominent; *main cauline leaves* 2.5–7 cm long, shortly petioled, with narrowly margined rachis and (8) 10–22 pairs of suborbicular, emarginate, flat leaflets 0.8–2.6 mm long diminishing upward along rachis, the terminal leaflet lanceolate, 2–3 times longer than the last pair; *peduncles* erect, all leaf-opposed, (0.4) 1–10 cm long, the lower ones usually elongate and the later ones (sometimes all) short; *racemes* narrowly lance-oblong in outline, tapering distally in bud, moderately dense, at and after anthesis 8–11 mm diam, the flowers ± 3-ranked when pressed, the thinly villosulous axis becoming (1) 1.5–9 cm long; *bracts* tardily deciduous, lance-acuminate or -caudate, 2.5–5 mm long, pale green or purplish, glabrous or thinly pilosulous dorsally, ciliolate and minutely gland-denticulate on margins; *pedicels* 0.2–0.4 mm long, charged at base with a pair of spicules and toward apex with a pair of minute glands; *calyx* at anthesis 4–4.8 mm long (a trifle accescent in age), densely pilose with stiff, incurved-ascending hairs up to 0.7–1.1 mm long, the shallow tube ± 1 mm long, the ribs slender becoming prominent, green or brownish, the membranous intervals (extending well above the sinuses between teeth) charged with one row of 4–5 elliptic, orange or golden glands, the lance-acuminate teeth 3.3–3.8 mm long, with long plane herbaceous tips, all of nearly equal length, the ventral pair a trifle wider; *petals* purplish-blue or pinkish, all (or at least the banner) minutely gland-sprinkled, the small inner petals scarcely differentiated in shape, free, perched ± 0.5 mm below separation of the filaments; *banner* 2.3–3.2 mm long, the claw 1.1–2 mm, the flabellate-obdeltate blade open at base, 1–1.2 mm long, 1.2–1.6 mm wide; *wing-* and *keel-petals* 1.5–1.9 mm long, the claws 0.2–0.3 mm, the obovate, shortly or obscurely auriculate blades 1.3–1.7 mm long, 0.8–1 mm wide; *androecium* 9-, rarely 10-merous, 3.5–4.8 mm long, the filaments free and purple for 1.2–1.6 mm, the connective glandular, the anthers yellow, 0.35–0.4 mm long; *pod* 2.6–3.3 mm long, strongly compressed, harp-shaped in profile, the style-base lateral, the prow purplish, slender but prominent, the valves thinly papery and transparent throughout, thinly pilosulous, charged with 2 gland-crescents, the distal one subhorizontal, the other vertical; *seed* olivaceous, lustrous, 1.6–2 mm long. — Collections: 22 (o).

Stony hills, arroyo beds, gravel flats, sometimes sheltering under shrubs, best known and apparently not uncommon, mostly at 10–800 m (35–2700 ft) but ascending on Cerro Giganta to 1260 m (4200 ft), in the small segment of Baja California Sur extending from the s. end of Sierra Giganta near lat. 24° 50′ N n.-ward on both slopes of the Sierra through Bahía Concepción and Mulegé to Santa Rosalía and San Ignacio near lat. 27° 20′ N; one record from the e. coast of Baja California (Edo) near lat. 30° N; Isla Tiburon (s.-w. side of island near El Sauz), lat. 26° 52′ N in Gulf of California; remotely disjunct on volcanic cones in Prosopis grassland near 1500 m in

Valle de Acatita (s. of Rancho Los Charcos) at the edge of Mapimí Depression, near 26° S in s.-w. Coahuila. —Flowering on the Pacific slope August to November, February to April, in Coahuila August and September. —*Representative*: COAHUILA: *McGill & Keil 8175* (NY). SONORA: *Moran 8794* (SD). BAJA CALIFORNIA (Edo); *Wiggins 20,870* (MICH, SD). BAJA CALIFORNIA (Sur): *Purpus 101 in 1898* (F, NY, UC); *Chambers 980* (DS, UC); *Moran 9035* (SD); *Gentry 4072* (ARIZ, topotypus); *Carter & Ferris 3920, 4783* (NY, UC); *Carter & Souza 5203* (NY); *Wiggins 15,557, Gentry 3725* (ARIZ, UC).

Marina vetula (Brandg.) Barneby, comb. nov., based on *Dalea vetula* (little old, perhaps in reference to the white-hairy flower-spikes) Brandg., Proc. Calif. Acad. Sci. II, **2**: 146. 1889. — "Comondu, San Gregorio." — Holotypus, collected by T. S. Brandegee at Comondú, 2 Mar 1889, UC! no material labelled "San Gregorio" found. —*Parosela vetula* (Brandg.) Rose, Contrib. U. S. Nat. Herb. **10**: 105. 1906.

Dalea bechtelii (Kenneth K. Bechtel, founder and president of Belvedere Scientific Fund, patron of CAS) Wiggins, Proc. Calif. Acad. Sci. IV, **30**: 244, pl. 13. 1965. — "...Santispaquis Cove, Bahía de la Concepción, Territorio del Sur, Baja California, Mexico, *Ira L. Wiggins and Dorothy B. Wiggins, 17,985,* 18 October, 1962..." — Holotypus, DS (not seen); isotypus, MICH!

The combination in *M. vetula* of an annual root with a degenerate corolla so small and so fugacious that it can play no part in attracting pollinators is matched elsewhere in *Marina* only by *M. evanescens.* The androecium of *M. evanescens* is reduced further than that of *M. vetula*, but its calyx and foliage are only slightly modified from patterns familiar in ser. *Chysorrhizae*, so that the species seems safely interpreted as a specialized derivative of the stock from which the sympatric *M. peninsularis* and *M. chrysorrhiza* originated. By contrast *M. vetula* is so different in detail from all congeners, sympatric or not, that firm clues to its kinship have been lost. The remarkable leaves, with their tiny round carnosulous lateral leaflets surmounted by a much longer, lanceolate terminal one, the deeply cleft calyx, and the membranous pod with lateral style-base, all in one way or another are unique features. The form (but not the texture) of the pod recalls that of the southern Mexican *M. gracilis*, which is also annual and also glabrous to the spikes, but the resemblances stop at that point. The petals of *M. vetula* are gland-sprinkled as in ser. *Chrysorrhizae*, but the banner-blade is differently shaped. Following Rydberg, I regard *M. vetula* as a taxonomically isolated monotype.

The description of *D. bechtelii* as a species distinct from *M. vetula* can be explained only in terms of a momentary lapse of memory. It was compared in the protologue not with any related marina, but with *Thornbera pringlei*, a true dalea which it resembles only in having free keel petals. The type-locality of *D. bechtelii* lies in the middle of the relatively small peninsular range of *M. vetula*, and the isotype I have seen is in all respects typical of the latter species.

A(iii). Series GEMMEAE Barneby

Stems and calyx pubescent; *calyx-lobes* charged dorsally with many small golden glands; *banner* glandless; *pod* compressed, the valves charged all over with very numerous small blister-glands.

Marina sect. **Marina** ser. **Gemmeae** Barneby, ser. nov., ser. *Unifoliolatis* proxima sed calycis dentibus extus nec tantum secus margines glandulosis necnon legumine glandulis confertis ubique consperso absimilis. — Sp. unica: **M. gemmea** Barneby.

19. MARINA GEMMEA Barneby
(Plate XXII)

Perennial, herbaceous or weakly suffrutescent in age, the stipules and stems distally pilosulous with stiff, spreading-incurved hairs up to 0.4–0.5 mm long, the leaflets glabrous, green, lineolate above, charged beneath with many small, elevated, golden, lens-like glands; *stems* diffuse or procumbent, up to 6–7 dm long, irregularly branching from near the middle upward, stramineous or becoming so, finely striate but eglandular, the racemes leaf-opposed and terminal to branchlets; *stipular spurs* almost 0, the blades submembranous, lanceolate, 2–3 mm long, densely micro-glandular dorsally; *post- and intra-petiolular glands* small but prominent, acute, golden; *main cauline leaves* 2–3 cm long, subsessile, the margined rachis flat and glabrous ventrally, keeled and strigulose dorsally, with 9–13 pairs of oblanceolate to narrowly obovate, emarginate, distally gland-denticulate, loosely folded leaflets 1.5–2 mm long, the shortly stalked terminal leaflet longer than the last pair, up to 3–4 mm long, the uppermost leaves shorter, with smaller, fewer (to 6 pairs) leaflets; *peduncles* slender, 3–6 cm long; *racemes* loosely but shortly 10–25-flowered, the flowers spreading and nodding in age, the axis becoming 1–2 cm long; *bracts* early deciduous, ovate, acute, submembranous, 1–1.5 mm long, strigulose and gland-sprinkled dorsally; *pedicels* 0.3–0.6 mm long, charged at apex with 2 grainlike glands; *calyx* 2.5–3.3 mm long, a little accrescent after anthesis, thinly strigulose with forwardly incurved-subappressed hairs up to 0.1–0.15 mm long, the tube 1.6–1.9 mm long, prominently 10-ribbed, the firm, narrow, recessed intervals charged with a chain of 8–12 tiny, subcontiguous glands, the teeth ovate to oblong-ovate, unequal, the ventral pair largest (0.9) 1.1–1.5 mm long measured to a lateral sinus but united through nearly half their length behind the banner, 0.8–1.2 mm wide, the dorsal one a trifle shorter and narrower, all charged both along the margins and dorsally with small, ± scattered glands; *petals* bicolored, the banner white in the middle, purple-edged, the wings and keel purple but paler toward the external margins, the inner inserted 0.8–1.1 mm above the hypanthium rim; *banner* ± 2.6 mm long, the blade obtusely pentagonal, minutely peltate at base, ± 1.5 mm long, 2.5 mm wide; *wings* 3–3.4 mm long, the claw 0.3–0.6 mm, the oblong-obovate blade ± 3 mm long, 1.7–2.1 mm wide; *keel* 3.2–4 mm long, the claws 0.5–0.8 mm, the very obliquely obovate blades 2.8–3.4 mm long, 2.2–2.7 mm wide; *androecium* 10-merous, ± 5 mm long, the longest filament free for ± 1 mm; *pod* 2.2–2.7 mm long, nearly ½-circular in profile, the ventral keel almost straight except at the slightly recessed pore, the dorsal keel prominent, the style-base terminal but excentric, the valves firmly papery, not hyaline at base, minutely strigulose distally and charged all over, from base upward, with many amber-colored, lenslike glands 0.15–0.25 mm diam; *seed* ± 1.7 mm long. — Collections: 1 (o).

Arid grassland at ± 430 m (1430 ft), known only from the type locality in the w. arm of the Balsas Depression in w.-centr. Michoacán.

Marina gemmea Barneby, sp. nov., notulis jam sub serie *Gemmeis* enumeratis inter congeneres praestans. — MICHOACÁN: between Nueva Italia and Apatzingán, in late flower and full fruit November 14, 1949, *H. E. Moore, Jr., E. Hernández X., & H. Porras H. 5754.* — Holotypus, BH; isotypi, CAS, MEXU, MICH.

Superficially *M. gemmea* suggests a coarse form of *M.* (ser. *Unifoliolatae*) *holwayi*, a species found in arid grasslands at about the same elevation in the eastern arm of the Balsas Depression, which differs in its subumbellate raceme of mostly 5–8 (not 10–25) flowers borne on a shorter, frailer peduncle. These two marinas are alike in the form and size of

the calyces and corollas, and their compressed, prominently keeled and relatively firm-valved pods are structurally similar. The unique feature of *M. gemmea* which sets it off from all *Unifoliolatae* is the elaboration of the gland-patterns on the back of the leaflets, the stipules, the calyx-teeth, and on the pod. In all other groups of sect. *Marina* the glands on the pod valves are arranged in one or usually two well-defined arcs or crescents. In *M. gemmea* the whole surface of the valves beyond the very small turbinate base of the fruit is charged with glands disposed in obscure rows arcuately ascending toward the style-base but so densely crowded as to form a continuously pustular surface. Seen in profile under a good light and small magnification the pod appears jewel-encrusted. A few members of sect. *Carroa* are characterized by a densely pustular pod, but the pod itself is then little compressed, not or scarcely keeled across the top, and the valves closely invest the seed.

The only perennial *Marina* with pubescent stems known to occur near or within the range of *M. gemmea* is the pliantly humifuse *M. procumbens*, easily distinguished by its relatively massive spikes of loosely pilosulous calyces with teeth only marginally, never dorsally glandular. As in all members of ser. *Chrysorrhizae*, the petals of *M. procumbens* are gland-sprinkled, whereas those of *M. gemmea* are glandless, as in ser. *Unifoliolatae*. The close relationship of *M. gemmea* is no doubt in the direction of the latter series.

A(iv). Series Unifoliolatae (Rydberg) Barneby

As ser. *Chrysorrhizae*, but banner glandless; *pedicels* mostly capillary; mostly annual, one sp. short-lived perennial. — Spp. 7, of s. Mexico and Guatemala.

Marina sect. **Marina** ser. **Unifoliolatae** (Rydb.) Barneby, stat. nov., based on *Parosela* subgen. *Trichopodium* VI. *Unifoliolatae* Rydb., N. Amer. Fl. **24**: 60. 1919 (lapsu "*Unifoliatae*"). — Sp. lectotypica: *P. unifoliolata* (Robins. & Greenm.) Rose = **Marina unifoliolata** (Robins. & Greenm.) Barneby.

The group *Unifoliolatae* was proposed by Rydberg to accommodate the two species in which all or most leaves are reduced to the terminal leaflet, but is expanded here to include the closely related annual marinas of southern Mexico which have the glandless petals of *M. unifoliolata* but less reduced foliage. These formed part of Rydberg's *Chrysorrhizae*, where they are clearly out of place. The leaves of *M. greenmaniana* are mostly unifoliolate but some are trefoil, like the more reduced leaves of normally pinnate *M. spiciformis*. Loss of lateral leaflets is, of course, a phenomenon widespread in many genera of xerophytic Leguminosae and is here a character of no more than specific value.

20. Marina holwayi (Rose) Barneby
(Plate XVI)

Very slender, diffuse or prostrate herbs, precociously flowering but potentially perennial of short duration, with a slender, at first subfiliform, orange taproot, appearing glabrous up to the calyx but the stipules, leaf-stalks, and sometimes some leaflets of younger leaves sparsely and minutely pilosulous, the flexuous, stramineous or purplish, eglandular stems irregularly but repeatedly branching from near the base, becoming (1) 1.5–6 (7.5) dm long, floriferous distally, the peduncles mostly leaf-opposed, the foliage bicolored, the leaflets green above, pallid beneath, lineolate both sides, not or obscurely punctate beneath but carinate by the midrib and charged with a large subapical gland; *leaf-spurs* up to 0.5 mm long; *stipules* subulate, 0.4–1 mm

long; *intrapetiolular gland* minute; *post-petiolular glands* subulate, prominent, yellowish; *main cauline leaves* subsessile, 6–22 mm long, with obscurely winged rachis and mostly 5–9, sometimes up to 11–12 pairs of oblong-obovate to obovate-obcordate, flat leaflets 1.5–3 mm long, the terminal leaflet often a trifle larger than the last pair, the upper (in some depauperate plants all) leaves with only 3–6 pairs of smaller but otherwise similar leaflets; *peduncles* slender, flexuously incurved to vertical, 1.6–3 cm long; *racemes* loosely but shortly or subumbellately (2) 3–8 (11)-flowered, the flowers loosely spreading to declined, the axis becoming 1–5 (7) mm long; *bracts* early caducous, submembranous, obovate or elliptic-ovate, glabrous dorsally, ciliolate, 0.8–1.2 mm long; *pedicels* 0.5–1 mm long, thinly pubescent, charged near apex with a pair of grainlike glands; *calyx* 2.5–3.1 mm long, thinly pilosulous, especially along ribs and margins of the teeth, with incurved-ascending hairs 0.1–0.25 mm long, the pleated tube 1.5–1.8 mm long, the prominent ribs filiform, the recessed, membranous intervals charged with a chain of 7–11 small, transparent glands, the plane, obovate, subacute, herbaceous teeth subhomomorphic, 0.8–1.4 mm long, the ventral pair a trifle larger than the rest, their margins denticulate by 1–3 impressed glands on each side; *petals* bicolored, the center of the banner blade and outer edge of keel whitish, drying yellowish, the rest magenta-purple, all eglandular, the inner ones perched ± 1–1.4 mm above hypanthium rim, the keel blades adherent by narrow overlap; *banner* (1.6) 2–2.8 mm long, the claw 0.6–1 mm, the cuneate-obovate, emarginate, often undulate-margined blade (1.1) 1.4–1.8 mm long, 1.8–2.3 mm wide; *wings* 3–4.1 mm long, the claw 0.5–0.8 mm, the obovate or oblong-obovate blade 2.7–3.3 mm long, 1.7–2.1 mm wide; *keel* (3.5) 4–4.5 mm long, the claw 0.8–1.1 mm, the broadly obovate blade (2.8) 3.1–3.6 mm long, 2.1–2.8 mm wide; *androecium* 10-merous, 5–5.3 mm long, the longer filaments free for 1.2–1.7 mm, the connective gland-tipped, the bluish anthers 0.4–0.6 mm long; *pod* in profile obliquely obovate-harp-shaped, 2.2–2.5 mm long, nearly as broad, keeled dorsally above the pore, the prow heavily crested, the style-base latero-terminal, the valves thinly papery, distally pilosulous and charged parallel to the prow and close below it with a transverse crescent of many small orange blister-glands; *seed* ± 1.7–2 mm long. — Collections: 17 (viii).

Open grassy places and gravelly hilltops in arid grassland or thorn forest, commonly on calcareous or gypseous clay soils, sometimes becoming colonial along highways, 720–1530 m (± 2400–5100 ft), locally plentiful on the floor and in the lower foothills of the e. arm of Balsas Depression in Morelos and adjoining Guerrero, Puebla, and n.-w. Oaxaca. — Flowering October to January. — *Representative*: MORELOS (mpos. Cuautla, Tlatizapan, Zacatepec, Puente de Ixtla): *Holway 18 in 1903* (GH, NY); *Ripley & Barneby 13,706* (CAS, MEXU, MICH, NY, US); *Bravo 3709* (MEXU); *Moore et al. 5015* (BH, MEXU). GUERRERO (mpos. Taxco, Iguala, Zumpango del Río); *Abbott 411* (ENCB); *Ripley & Barneby 13,736* (CAS, GH, MEXU, MICH, K, NY, US); *Pringle 10,320* (F, L, M, MEXU, NY, OKLA, UC, W, Z); *Moore & Wood 4726* (MEXU). PUEBLA (mpos. Izúcar de Matamoros, Tehuitzingo): *Ripley & Barneby 14,570* (CAS, IA, MICH, US), *13,687* (CAS, GH, K, MEXU, MICH, NY, US). OAXACA (mpo. Huajuapan de León): *Ripley & Barneby 14,695* (CAS, DAO, MICH, NY, US).

Marina holwayi (Rose) Barneby, comb. nov., based on *Parosela holwayi* (Edward Willet Dorland Holway, 1853–1928) Rose, Contrib. U. S. Nat. Herb. **8**: 304. 1905. — "Collected by E. W. D. Holway near Iguala, Guerrero, November 3, 1903 (nos. 48, type, & 5139)..." — Holotypus, *Holway 48*, US!

This is a frail, diffuse or prostrate herb, with fine pliant stems indefinitely branched upward, and many subumbellate, few-flowered racemes at anthesis held aloft on leaf-

opposed peduncles, but procumbent in fruit. The habit of growth and the short-lived perennial root recall the more slender Baja Californian *Chrysorrhizae* but the glandless banner, open at base and incipiently lobed in the upper half of the blade, is characteristic of the southern Mexican *Unifoliolatae*. Among the latter it is the only known species not obligately annual; it thus serves in a measure to link the two series *Chrysorrhizae* and *Unifoliolatae*. The only other *Marina* in southern Mexico with subumbellate inflorescence is the distantly allopatric *M. gracillima* of sect. *Carroa*, quickly distinguished by its prostrate, livid-glaucescent stems and completely glabrous calyx and ovary.

On arid heavily pastured hills, as in the type-region around Iguala, *M. holwayi* is truly prostrate and humifuse, only the incurved flowering peduncles rising a few centimeters from the ground. Where they come into competition with grasses or are crowded together in closed communities (as sometimes in highway ditches) the plants run together to form densely woven mats of foliage. The main cauline leaves vary much in length, and their leaflets in number, usually from six to nine, rising occasionally to eleven pairs. As often in *Marina* and *Dalea*, the upper leaves tend to be shorter and simpler than the rest, sometimes reduced to only 3–5 pairs of leaflets.

21. Marina melilotina Barneby
(Plate XVIII)

Erect monopodial annuals from an orange-brown taproot, 4–8 (10) dm tall, repeatedly (subdichotomously) branching upward from well below the middle to form an airy panicle of broad, umbrella-shaped outline, glabrous up to the pedicels and calyx, the slender, distally filiform stems greenish-stramineous, lustrous, eglandular or only remotely and minutely impressed-punctate, the many racemes mostly leaf-opposed but also terminal to all the ultimate branchlets, the leaflets yellow-green and lineolate above, paler or subglaucescent and minutely punctate beneath; *leaf-spurs* less than 1 mm long; *stipules* subulate to linear-attenuate, entire or fimbriolate at base, 1–4 mm long, becoming dry and fragile; *intra-* and *post-petiolular glands* small (0.1–0.2 mm) but prominent, mammiform; *main cauline leaves* 2–4 cm long, subsessile or shortly petioled, with eglandular, obscurely margined rachis and 3–7 pairs of oblanceolate, obtuse leaflets mostly 4–9 mm long, the terminal leaflet stalked beyond and usually a little longer than the last pair, the larger leaflets distinctly gland-crenulate; *racemes* (disregarding depauperate subterminal ones) slenderly peduncled, the peduncles 1–5 cm long, openly 7–20 (25)-flowered, the flowers and fruits loosely ascending, the axis becoming (1) 2–8 (13) cm long; *bracts* early deciduous, lance-acuminate or elliptic, boat-shaped, 1–4 mm long, keeled dorsally, minutely ciliolate; *pedicels* filiform, ascending, loosely strigulose, 1–1.5 mm long, charged near apex with a pair of grainlike glands; *calyx* 4.3–5 mm long, pectinately ciliolate along the sharply prominent ribs and margins of the flat, herbaceous-tipped teeth with stiff, spreading-incurved hairs up to 0.2–0.35 mm long, the tube 2.1–2.5 mm long, the membranous, recessed intervals between the ribs charged with a chain of 6–8 small, elliptic, honey-colored glands, the lance-ovate teeth slightly unequal, the dorsal one longest, 2.2–2.5 mm long (as long to slightly longer than tube); *petals* bicolored, eglandular, the banner-blade white with purple lobes, in age rubescent, the inner ones vivid magenta-purple, perched at ± 1.2–2 mm above hypanthium rim, the keel-blades

adherent by narrow overlap; *banner* 3.7–4 mm long, the claw 2–2.2 mm, the pentagonal blade 1.8–2.3 mm long, 2.8–3 mm wide, distally recurved through 45°; *wings* ± 4.5 mm long, the claw 0.7–1.1 mm, the broadly obovate, short-auricled blade 3.7–4 mm long, 2.5–2.7 mm wide; *keel* 6.3–7 mm long, the claws 1.8–2.4 mm, the broadly obovate, short-auricled blades 4.7–5 mm long, 3.2–3.5 mm wide; *androecium* 10-merous, 7–8 mm long, the longer filaments free for ± 2 mm, the connective gland-tipped, the anthers yellowish, 0.7–0.8 mm long; *pod* nearly 3 mm long, obliquely obovate in profile, with prominent dorsal crest and prow, the style-base latero-terminal, the valves transparent in lowest ¼, papery and thinly pilosulous distally, charged above middle with 2 subvertical crescents of blister-glands; *seed* ± 2 mm long. — Collections: 2 (i).

Brushy hillsides, river-banks, and roadsides, sometimes forming weedy colonies in disturbed soils, in arid grassland and xeric shrubbery, 810–1530 m (2700–5100 ft), seldom collected but perhaps passed over for superficially similar species such as *M. scopa* and *M. neglecta* var. *elongata*, known only from two stations in the e. arm of Balsas Depression, in s. Puebla and n.-centr. Guerrero. — Flowering October to December. — *Material*: PUEBLA: (typus). GUERRERO. Zumpango del Río: cañón de Zopilote between Mexcala and Zumpango, km 278, 2700 ft., *H. E. Moore Jr. 5198* (BH, MEXU).

Marina melilotina (suggesting melilot in habit) Barneby, sp. nov., *M. pueblensi* (Brandg.) Barneby affinis, sed statura majori, caulibus ad racemos usque glabris, bracteis ab alabastris cito deciduis, et praesertim floribus majusculis, calyce 4.3–5 (nec 3–3.7) mm, vexillo 3.7–4 (nec 1.7–2.4) mm, carinaeque laminis 4.7–5 (nec 1.8–2.4) mm longis, androecioque 10-mero 7–8 mm (nec saepius 9-mero 3–4 mm) longo procul abstans. — Herbae annuae elatae, habitu *M. scopam* Barneby simulantes, sed foliolis paucijugis, calycis tubo secus costas pectinato-ciliolato, necnon legumine compresso remotae. — PUEBLA: colonial along grassy roadside and on brushy hills adjoining, 5100 ft., n.-w. of Tehuitzingo, Nov 7, 1964, *H. D. Ripley & R. C. Barneby 13,686.* — Holotypus, NY; isotypi, CAS, K, US.

This species and *M. pueblensis*, which occur in the same region and in similar habitats, are similar also in foliage and in the form of the individual flower and pod. The differences between them are of about the same order as between the monophyllidious *M. unifoliolata* and *M. greenmaniana*. The flower of *M. pueblensis* is tiny and inconspicuous even at full anthesis, and the usually nonandrous androecium is proportionately short. By contrast the flower of *M. melilotina* is showy, with keel-blades ± 5 (not 2–2.5) mm long and a much longer, decandrous androecium 7–8 (not ± 4) mm long. In general *M. melilotina* is a taller plant, individuals standing alone and uncrowded forming an inversely pyramidal, broad-headed panicle of racemes reaching 8 dm in height, whereas the most vigorous plants of *M. pueblensis* tend to be diffusely branched mostly near the base, with main branches ascending from near the ground and relatively simple upward. The bracts of *M. melilotina* are thrown off from under the forming buds in the manner usual in sect. *Marina*, in contrast to the persistent glumaceous bracts which are such a striking and unique feature of *M. pueblensis*. In its relatively few leaflets and its pectinately ciliolate calyx *M. melilotina* resembles *M. neglecta* var. *neglecta*, but differs in being annual and monopodial, and in the open and relatively few-flowered raceme. In the type-locality *M. melilotina* grew in close association with *M. neglecta* var. *elongata*, instantly recognized as different by the glabrous calyx.

22. Marina pueblensis (Brandegee) Barneby

(Plate XVIII)

Slender annuals from an orange taproot, branching from near the base or from well below the middle, 1–5.5 (6) dm tall, appearing glabrous to the inflorescence (the leaflets really so), but the leaf-stalks, the stems (minutely punctate but not verruculose) at least distally, and the raceme-axis finely pilosulous with subappressed or spreading-incurved hairs up to 0.15–0.25 mm long, the foliage green, the leaflets lineolate both sides, smooth above, paler and minutely punctate beneath, their often purple margins gland-crenulate; *leaf-spurs* less than 0.5 mm long; *stipules* narrowly subulate to linear-attenuate, 0.8–2 mm long, purple-castaneous becoming dry and fragile; *intrapetiolular gland* small; *post-petiolular glands* prominent, subulate, orange; *main cauline leaves* 1.5–3.5 cm long, shortly petioled, with scarcely margined rachis and (2) 3–5 pairs of oblanceolate, oblong-elliptic, or obovate, subacute or obtuse and gland-mucronate, flat leaflets 2.5–6.5 mm long, the terminal leaflet similar but longer, mostly 5–11 mm long, stalked beyond the last pair; *peduncles* very slender, mostly leaf-opposed, (0.4) 1–3 cm long; *racemes* loosely or remotely (4) 8–20 (25)-flowered, the flowers ascending, the axis (1) 2–9 cm long; *bracts* ovate-acuminate, sheathing at base, 0.8–2 mm long, persistent, early becoming brown and glumaceous, glabrous dorsally, minutely gland-fimbriolate; *pedicels* subfiliform, 0.9–1.4 mm long, charged at apex with a pair of minute glands; *calyx* 3–3.7 mm long, thinly pectinate-pilosulous especially along the ribs with stiff, spreading-incurved, lustrous hairs up to 0.15–0.25 mm long, the tube accordion-pleated, (1.5) 1.7–2 mm long, its orifice subsymmetrical, the recessed, membranous intervals charged with a chain of 5–8 small, yellowish glands, the membranes produced high into the teeth, the teeth unequal, the dorsal one longest and proportionately narrowest, 1.3–1.9 mm long, the ventral and lateral pairs shorter, obovate-short-acuminate, 1.1–1.5 mm long; *petals* vivid magenta-purple except for a pale (rubescent) eye-spot on blade of banner, all eglandular, the inner ones perched at 1.2–1.5 mm above hypanthium rim, the keel-blades united by narrow overlap; *banner* 1.7–2.4 mm long, the claw 1.1–1.6 mm, the reniform or angled, emarginate or subacute, incipiently peltate blade 1–1.4 mm long, 1.3–1.8 mm wide; *wings* 2.3–2.9 mm long, the claw 0.6–0.8 mm, the obovate-oblong blade 1.8–2.3 mm long, 1–1.5 mm wide; *keel* 2.5–3.4 mm long, the claws 0.7–1.3 mm, the obovate blades 1.8–2.4 mm long, 1.2–2.6 mm wide; *androecium* 9 (rarely 10)-merous, (2.8) 3.3–4 mm long, the longer filaments free for 0.8–1 mm, the connective gland-tipped, the pale blue anthers 0.3–0.7 mm long; *pod* 2–2.4 mm long, obovate-harp-shaped in profile, the style-base terminal but excentric, sharply prowed, the valves membranous at extreme base, thence papery, thinly pilosulous, and charged with 2 crescents of blister-glands; *seed* ± 1.6 mm long; 2n = 20 (Mosquin). — Collections: 8 (v).

Dry stony or grassy hillsides, often in drought-deciduous thorn-scrub, on calcareous, volcanic, and perhaps other bedrock, 855–1200 m (± 2850–5750 ft), local but forming colonies, e. arm of Balsas Depression in Morelos, Puebla, and n. Oaxaca, extending e. in Puebla across the low divide to the headwaters of Río Salado in the cuenca de Río Papaloapan. — Flowering September to November. — *Material*: Morelos. Cuernavaca, *Matuda 222* (MEXU); Tlatizapan: near Moyotepec, *Ripley & Barneby 13,702* (CAS, NY, US). Puebla. Tehuacán: *Purpus 5649* (F, UC); Coxcatlán (typus); Izúcar de Matamoros: 8 mi. s.-e. of Izúcar, *Ripley & Barneby 13,689* (CAS, GH, K, MEXU, MICH, NY, US); Tehuitzingo: Tehuitzingo, *Ripley & Barneby 14,575* (DAO, IA, NY, US); Petlalcingo: n.-w. of Petlalcingo, *Ripley & Barneby 14,576* (CAS, DAO, NY, US). Oaxaca. Huajuapan de León: Chazumba, near the Puebla boundary, *Ripley & Barneby 14,706* (NY).

Marina pueblensis (Brandg.) Barneby, comb. nov., based on *Dalea pueblensis* (of Estado de Puebla) Brandg., Univ. Calif. Pub. Bot. **4**: 86. 1910. — "Collected near Coxcatlan, No. 4146..." — Holotypus, collected in Sept 1909, by Carl Anton Purpus, UC! isotypi, F, GH, NY, US! — *Parosela pueblensis* (Brandg.) Rydb., N. Amer. Fl. **24**: 52. 1919.

This is a thin-stemmed, sparsely leafy plant, not easily singled out from the tangle of grasses and other small herbs among which it delights to grow, except early in the day, before the caducous, small but vivid magenta-purple petals have fallen to the ground. The species is strongly characterized by the annual root, shining, wiry stems, few (mostly 7–11) leaflets ample in context of ser. *Unifoliolatae*, and openly or remotely flowered racemes of tiny, pectinately ciliolate calyces, each subtended by a little persistent, papery brown bract. According to the label the type collection came from elevations of 7000–8000 ft, but this is probably a mistake on Brandegee's part. Coxcatlán lies on the floor of Río Salado valley downstream from Tehuacán, and all subsequent collections of *M. pueblensis* have been made at levels far below the 2000 meter contour.

For discussion of kinship, see under *M. melilotina* (above) and 24. *M. unifoliolata*.

23. Marina spiciformis (Rose) Barneby
(Plate XIX)

Slender annuals, variable in habit, commonly with an erect central axis giving rise shortly above the base or sometimes above the middle to several incurved-ascending branches, but the primary axis sometimes early inhibited and then appearing diffuse or prostrate, mostly 2–4 dm tall, appearing or truly glabrous up to the inflorescence, but the purplish or stramineous, minutely verruculose stems often thinly crisp-pilosulous distally, the always glabrous leaflets bicolored, green (or in age purple) and smooth above, paler and minutely punctate beneath, lineolate on both sides, the commonly reddish margins gland-crenulate; *leaf-spurs* up to 0.8 mm long; *stipules* linear-attenuate, purplish, often fimbriolate at base, 1.5–3.5 mm long; *intra-petiolular gland* 1, spiculiform; *post-petiolular glands* prominent, subulate or prickle-shaped; *leaves* (1) 1.5–3 cm long, shortly petioled or subsessile, the slender, obscurely margined rachis sparsely gland-sprinkled, the leaflets (3) 5–9, broadly orbicular-obovate to elliptic-obovate, obtuse but gland-mucronulate, (4) 5–13 mm long, flat, the larger ones often distinctly penninerved, the terminal one stalked beyond the last pair and largest of all; *peduncles* mostly terminal to branchlets, only the first of each main axis leaf-opposed, 0.5–4.5 cm long; *racemes* relatively dense, (10) 15–50-flowered, spike-like and strongly tapering in early anthesis, the fruiting calyces loosely ascending, subcontiguous, the thinly pilosulous or glabrous axis becoming (0.5) 1–3.5 cm long; *bracts* early deciduous, narrowly lance-acuminate, 2–3 mm long, subglabrous, becoming papery and castaneous, minutely gland-pustulate dorsally, the margins often gland-toothed; *pedicels* 0.3–0.7 mm long; *calyx* 2.7–3.4 mm long, subglabrous up to the thinly and minutely pilosulous teeth, exceptionally glabrous throughout, the strongly pleated tube 1–1.4 mm long, at first constricted at the subsymmetric mouth, the firm, recessed intervals charged with one row of ± 5–8 small, subcontiguous, narrowly oblong blister-glands, the plane, marginally gland-denticulate teeth somewhat unequal, the dorsal one lanceolate, 1.6–2.1 mm long, the ventral pair lance-ovate, shorter; *petals* opening bicolored, the banner purple at base of blade, whitish but early rubescent distally, the inner ones violet-purple, elevated ± 0.7–1.1 mm above the hypanthium, all usually eglandular, the keel or banner rarely charged with 2–3 minute glands; *banner* 2–2.4 mm long, the claw ± 0.5 mm, the obovate or elliptic, emarginate, sometimes obscurely 4-lobed blade recurved through ± 40°, 1.5–1.8 mm long, 1.2–1.6 mm wide; *wings* 2.6–3 mm long, the claw 0.5–0.7 mm, the oblong-obovate,

subtruncate blade 2.1–2.5 mm long, 1–1.4 mm wide; *keel* 2.8–3.4 mm long, the claws 0.8–1.1 mm, the obovate blades 1.9–2.4 mm long, 1.2–1.6 mm wide; *androecium* 10-merous, 3–3.3 mm long, the longest filament free for 0.6–1 mm, the blue, gland-tipped anthers 0.25 mm long; *pod* 2–2.5 mm long, turgidly oblong-obovoid, the style subterminal, bicarinate by the sutures, the valves firmly papery beyond the obconic base, charged with 2 subvertical crescents of small blister-glands, puberulent above the middle or rarely glabrous; *seed* ± 1.8 mm long; $2n = 20$ (Mosquin). — Collections: 14 (iv).

Dry gravelly and grassy places on brushy hillsides, sometimes becoming weedy in disturbed soil along highways, 750–1560 m (2500–5200 ft), forming colonies but local in scattered stations in the Balsas Depression in Michoacán, Guerrero, southern México, and Morelos; apparently isolated (or possibly introduced) in west-central Chiapas. — Flowering in September to November. — *Representative*: MICHOACÁN: *Hinton 13,273* (ARIZ, F, W), *15,311* (W). GUERRERO: *Pringle 10,059* (ARIZ, F, L, M, MEXU, MICH, NY, OKLA, TEX, UC, W, Z, topotypi); *Ripley & Barneby 13,735* (CAS, K, MEXU, NY, TEX, US). MEXICO: *Hinton 1938* (NY, MEXU); *Schubert & Pompa 2134* (NY). MORELOS: *Ripley & Barneby 13,713* (CAS, NY, US). CHIAPAS: *Breedlove & Raven 13,376* (US).

Marina spiciformis (Rose), comb. nov., based on *Parosela spiciformis* (spikelike, of the young raceme) Rose, Contrib. U. S. Nat. Herb. **8**: 303. 1905. — "Collected by C. G. Pringle near Iguala, Guerrero, October 3, 1900 (no. 9255)." — Holotypus, US! isotypus, MEXU! — *Dalea spiciformis* (Rose) Bullock, Kew Bull. **1939**: 198. 1939.

Of the annual marinas found in the Balsas Depression *M. spiciformis* alone is characterized by the presence of only two to four pairs of leaflets in most leaves combined with moderately dense racemes of small flowers (at anthesis ± 7 mm long). The species is closely related to *M. unifoliolata* and *M. greenmaniana*, in which the leaf is almost always reduced to an enlarged terminal leaflet, more closely so than to any with more ordinary, pinnate foliage. Occasional leaves of *M. greenmaniana* have an accessory pair of small leaflets below the terminal one, and these resemble the trifoliolate leaves found high on the stems in some specimens of *M. spiciformis*. As in *M. greenmaniana*, there is some variation in the pubescence of the calyx. Usually the tube is glabrous and the teeth are puberulent with short, stiffly incurved hairs; but these hairs are sometimes lacking.

The main range of *M. spiciformis*, which extends from central Morelos west approximately to Apatzingán in Michoacán, is a very natural one, and the two records from Chiapas, from along highways north and east of Tuxtla Gutiérrez, are unexpected and disconcerting. In two stations in Guerrero and Morelos where I observed *M. spiciformis* the plants grew most luxuriantly in the loose gravel along roads and on the grassy verge kept trimmed by machete, the microhabitat favored also by *M. neglecta*. I suspect that *M. spiciformis*, like its relative, is beginning to spread as a ruderal, and the Chiapas population may well have been weedy.

24. MARINA UNIFOLIOLATA (Robinson & Greenman) Barneby
(Plate XX)

Slender annual herbs (1) 1.5–4.5 (5) dm tall, either simple and erect or more often branching from near the base, the branches divaricate and then incurved-ascending, commonly longer than the primary erect axis, glabrous up to the finely pilosulous inflorescence, the wiry, terete, stramineous or purplish, finely punctate and distally micro-tuberculate stems floriferous nearly throughout or at least from the middle up-

ward, the peduncles mostly leaf-opposed, the large, solitary, terminal leaflets bicolored, green above, pallid beneath, lineolate both sides; *leaf-spurs* up to 0.5 mm long; *stipules* triangular-subulate, 0.3–1 mm long, their margins minutely gland-fimbriolate; *intra-* and *post-petiolular glands* forming a triad of purple grains at apex of petiole; *leaves* 7–30 (35) mm long, the petiole 1.5–16 mm long, subterete, minutely glandular, the petiolule inserted behind the lower margin of the terminal leaflet (this hence subpeltate), the flat blade broadly ovate-deltate, suborbicular, or broader than long and therefore subreniform, truncate at base, very obtuse to openly emarginate at apex, 5–23 mm long, 5–25 mm wide, its prominent costa giving rise on each side to 8–18 parallel, divaricate secondary veinlets, its margin finely crenulate and charged with glands at first prominent but finally impressed; *peduncles* wiry, 0.5–3 cm long; *racemes* loosely (7) 10–35 (40)-flowered, the flowers ascending, the pilosulous axis becoming (1) 1.5–8 cm long; *bracts* caducous from a decurrent spur, submembranous, lance-acuminate beyond the cuneate base, (1.3) 1.9–2.6 mm long, their margins ciliolate and gland-pectinate below the middle, subglabrous dorsally; *pedicels* flexuously ascending, very slender, 0.6–1.4 mm long, charged at apex with a pair of grain-like glands; *calyx* 3–4 mm long, pectinately ciliolate along the sharply prominent ribs and the margins of the teeth with stiff, spreading-incurved hairs up to 0.2–0.3 mm long, the tube 1.5–1.8 mm long, the recessed, submembranous intervals charged with a chain of 6–7 transparent, elliptic glands, the lanceolate, plane, green teeth subequal, 1.5–2.3 mm long, but the ventral pair united behind the banner through nearly half their length, the margins of each tooth charged on each side with 1–2 minute glandular teeth and gland-tipped; *petals* bicolored, the banner whitish, early rubescent, the inner pairs magenta-purple, all eglandular, the inner perched at nearly the same level 1.1–1.5 mm above hypanthium rim, the keel-blades narrowly imbricated and adherent; *banner* spatulate, 2.2–3 mm long, strongly curved backward distally, the claw 0.5–0.9 mm long, the blade nearly as broad as long, obtusely 4-lobed; *wings* 3.5–5 mm long, the claw 0.6–0.8 mm, the blade obliquely obovate, 3–4.5 mm long, 1.9–2.8 mm wide; *keel* usually a trifle longer than wings, 3.8–5.2 mm long, the claws 1–1.3 mm, the broadly obovate blades 2.9–4 mm long, 2.1–3.4 mm wide; *androecium* 10-merous, 4.3–5.5 mm long, the longer filaments free for 1.1–1.4 mm, the connective glandular, the pale bluish anthers 0.35–0.45 (0.5) mm long; *pod* obliquely obovate in profile, strongly compressed, 2.1–2.5 mm long, constricted at the dorsal pore, the style-base terminal but excentric, the prow slenderly keeled, the valves firm beyond the hyaline base, thinly pilosulous distally, charged with 2 crescents of blister-glands. — Collections: 12 (ii).

Open or brushy grasslands, in thin oakwoods or in oak-juniper woodland, descending into ipomoea-thorn-forest, 500–1650 m (± 1650–5500 ft), local but forming colonies, widely dispersed from s.-e. México and adjoining Guerrero w. through the Balsas Depression and foothills of Sierra Madre del Sur to s. Jalisco; perhaps somewhat isolated in valley of Río Grande de Santiago in w. Jalisco. — Flowering September to January. — *Material*: JALISCO. Tequila (typus); Tecatitlán: Gallardo, 10 km n.-w. of Tepalcatepec, Mich., *Rzedowski 17,506* (ENCB, MICH); Sierra Corales, *Feddema 2235* (MICH). MICHOACÁN. Nocupétaro: road to Huetamo, *Moore et al. 5714* (MEXU, MICH, UC). Apatzingán: Aguililla, *Hinton 15,299* (F, MEXU, NY, UC). Coalcomán: Aguila, *Hinton 16,158* (NY, OKLA, UC). GUERRERO. Coyuca de Catalán: Coyuca, *Hinton 6035* (F). Mina distr., at Zihuagio, *Hinton 9719*. Aldama distr., at Temisco, *Mexia 8811a* (UC). Taxco: Taxco, *Ripley & Barneby 13,717* (CAS, K, MEXU, MICH, NY, US). MEXICO (Edo): Santo Tomás de los Plátanos: below Santo Tomás, *Ripley & Barneby 14,887* (CAS, DAO, GH, MEXU, MICH, NY, US). Sultepec: Sultepec, *Matuda 32,138* (MEXU).

Marina unifoliolata (Robins. & Greenm.) Barneby, comb. nov., based on *Dalea unifoliolata* Robins. & Greenm. Proc. Amer. Acad. **29**: 383. 1894. max. pro parte (exclus. *Mueller 663*). — "...in dry, thin soil, barranca of Tequila, Jalisco, by Mr. Pringle, 6 October, 1893 (no. 4585)." — Lectotypus (Rydberg, 1919, p. 60, by inference), *Pringle 4585*; holotypus, GH! isotypi, BR, F, M, MEXU, NY, NY, W, Z! — *Parosela unifoliolata* (Robins. & Greenm.) Rose, Contrib. U. S. Nat. Herb. **8**: 303. 1905 ("*unifoliata*").

This species and *M. greenmaniana* together differ from all other described marinas in their unifoliolate leaves; from one another they differ in size of all their parts, *M. greenmaniana* being as it were a diminished version of *M. unifoliolata*, with this further difference, that the androecium is reduced from ten to nine members. The protologue of *Dalea unifoliolata* was based on a mixture of the two species, an error of judgment very natural at the time. Among numerous subsequent collections no morphologically intermediate forms have as yet been discovered, and the ranges of the two entities seem to be distinct, although they are nearly in contact in extreme southern Mexico state. Despite the similarity in general form, I believe they represent discrete, geographically vicariant species.

Growing and flowering among the drying weeds and yellowing grasses of late summer and fall, the plants of *M. unifoliolata* and *M. greenmaniana* are well camouflaged by the wiry fineness of their stems and by the attitude of the leaf-blades, which are tilted edgewise to the zenith like diminutive platyopuntia pads and present to the eye only a thin line, often tinged with purple. In the early morning hours, however, before the fleeting purple sparks of the petals have fallen to the ground, the plants may be picked out readily enough.

25. Marina greenmaniana (Rose) Barneby
(Plate XX)

Closely resembling *M. unifoliolata* in habit and foliage, but more slender, often diminutive, 0.4–2.5 dm tall, always smaller-flowered, pubescent as its relative or in one var. wholly glabrous; *leaves* 0.5–2.5 cm long, the petiole 2–10 mm, the blade of the usually solitary, terminal leaflet orbicular or a little wider than long 3–17 mm long, gland-crenulate, its insertion on the petiole basal or almost so, rarely accompanied by one pair of similar but smaller lateral leaflets, especially in some uppermost leaves; *peduncles* (3) 5–20 mm long; *racemes* (2) 5–20 (26)-flowered, the axis 3–23 (27) mm long; *bracts* rhombic-ovate-acuminate, 1.2–2 mm long, deciduous from the buds; *pedicels* 0.4–0.7 mm long; calyx (pectinately ciliolate along the pleated ribs or glabrous) 2.1–2.5 mm long, the tube 1.2–1.5 mm long, the membranous, recessed intervals charged with a chain of ± 7 elliptic glands, the teeth subhomomorphic, ovate, gland-denticulate and -mucronulate, the ventral pair united a little higher behind the banner than to their lateral neighbors; *petals* bicolored (as *M. unifoliolata*), eglandular, the inner ones perched ± 1–1.2 mm from hypanthium rim; *banner* 1.5–1.9 mm long, the claw 0.7–0.8 mm long, the blade abruptly recurved, obtusely 4-lobed, 0.8–1.2 mm long, 1–1.5 mm wide; *wings* 1.9–2.5 mm long, the claw 0.3–0.5 mm, the blade 1.6–2.2 mm long, 1–1.4 mm wide; *keel* (either slightly longer or shorter than wings) 2–2.7 mm long, the claws 0.6–1 mm, the blades suborbicular-obovate, 1.5–1.7 mm long, 1.1–1.5 mm wide; *androecium* 9-merous, 2.2–3 mm long, the longer filaments free for 0.5–0.8 mm, the connective gland-tipped, the bluish anthers 0.2–0.3 mm long; *pod* 2–2.5 mm long, obliquely compressed-obovoid, the persistent style-base not over 0.3 mm long, the ventral suture crested above the dorsal pore, the prow slender but prominent, the valves hyaline at base, distally firm, thinly pilosulous or glabrous, charged with 2 subvertical gland-crescents; 2n = 20 (Mosquin, var. *greenmaniana*).

As noted under the preceding species, *M. greenmaniana* is related most closely to *M. unifoliolata*, but the occurrence in some plants of a few trifoliolate leaves, especially high on the stems (usually just preceding a peduncle) suggests kinship with *M. spiciformis* also. The cauline leaves of the latter have, however, 2–4 pairs of proportionately longer leaflets and the appearance of the plant is accordingly different. Rose thought that the leaves of *M. greenmaniana* are "normally" trifoliolate, but this type of leaf is actually exceptional.

In *Dalea*, interpopulational variation in pubescence is commonplace and often occurs sporadically, going across the grain of evolutionary sequence rather than with it; in *Marina* it is commonly better correlated with other features and therefore of greater taxonomic use. I am prompted by this generality to recognize within *M. greenmaniana* two varieties, one pubescent as in *M. unifoliolata*, the other quite glabrous.

Key to the Varieties of *Marina greenmaniana*

1. Axis of the raceme, ribs of the calyx, and pod all pilosulous to pectinately ciliolate. 20a. var. *greenmaniana*.
1. Plant totally glabrous. 20b. var. *muelleri*

25a. Marina greenmaniana (Rose) Barneby var. greenmaniana

Pubescent as given in the key; 2n = 20 (Mosquin). — Collections: 8 (vi).

Open brushy hillsides, in thorn-forest and ascending into thin oak woodland, 1500–1900 m (± 5000–6330 ft), reportedly up to 2400 m, local (but probably often overlooked), e. end of Balsas Depression in s. México and Puebla (to be expected in Morelos), extending e. in Puebla to the upper margins of the Tehuacán desert and s.-w. through the Mixteca hill-country to the valley of Oaxaca. — Flowering September to January. — *Material*: México. Tonatico: near Tonatico, *Matuda 27,518* (MEXU, NY). Puebla. Izúcar de Matamoros: 8 mi. s.-e. of Izúcar, *Ripley & Barneby 13,695* (CAS, NY). Petlalcingo: 12 mi. s.-e. of Petlalcingo, *Ripley & Barneby 13,675* (CAS, K, MEXU, NY, US). Santiago Miahuatlán: 6 mi. n. of Tehuacán, *Ripley & Barneby 14,718* (NY). Oaxaca. Nazareno Etla: Las Sedas (typus); Etla to Huitzo, *Ripley & Barneby 14,661* (CAS, NY, US); 7 mi. n. of Telixtlahuaca, *Ripley & Barneby 14,672* (CAS, DAO, GH, IA, MEXU, MICH, NY, UC, US).

Marina greenmaniana (Rose) Barneby, comb. nov., based on *Parosela greenmaniana* (Jesse More Greenman, 1867–1951) Rose, Proc. Amer. Acad. **8**: 303. 1905. — "Collected by C. G. Pringle on dry soil at Las Sedas, altitude 2400 meters, September 29, 1894 (no. 4928)." — Holotypus, US! isotypi, BR, F, GH, M, MEXU, NY, UC, Z!

25b. Marina greenmaniana (Rose) Barneby var. muelleri Barneby (Plate XX)

Plant quite glabrous. — Collections: 2 (i).

Habitat of var. *greenmaniana*, sometimes associated with it but in discrete colonies, known only from s. Puebla and perhaps adjoining Veracruz. — *Material*: Veracruz (?): typus. Puebla. Petlalcingo: 12 mi. s.-e. of Petlalcingo, *Ripley & Barneby 13,675* (CAS, K, NY, US).

Marina greenmaniana (Rose) Barneby var. **muelleri** (Friedrich Müller, collected in Mexico 1853) Barneby, var. nov., a var. *greenmaniana* omnium partium glabritie abstans. — MEXICO: "Orizaba," anno 1853, *F. Müller 663.* — Holotypus, NY (herb. Meissner.); isotypus, BR.

A(v.). Series Marina

Slender annuals, glabrous to the silky-pilose calyx; *leaflets* numerous (7–17 pairs), small; *flowers* loosely racemose, few (2–7), spreading-declined in age; *calyx-ribs* pilose with straight (not incurved) hairs; *calyx-teeth* 5–9-toothed; *pod* strongly compressed, charged with a distal transverse and a proximal subvertical crescent of blister-glands. — Sp. 1, of s. Mexico and Guatemala.

Marina Liebm., loc. cit., pro gen., sensu str. — Sp. typica: **M. gracilis** Liebm.

Parosela subgen. *Trichopodium* I. *Delicatae* Rydb., N. Amer. Fl. **24**: 51. 1919. — Sp. typica: *P. delicata* Rose = (syn. tax.) **M. gracilis** Liebm.

26. Marina gracilis Liebmann

(Plate XVII)

Slender, diffuse or prostrate, sparsely leafy herbs, annual or perhaps rarely persisting into a second season, glabrous to the inflorescence, the stems either simple proximally and branching beyond the middle, or branched from base upward and the early branches then diffuse and incurved-ascending, all smooth or minutely micro-tuberculate distally, stramineous or purplish, (0.5) 1–3.5 (4) dm long, floriferous nearly throughout or from the middle upward, the peduncles mostly leaf-opposed, the foliage green or commonly red-tinged, the leaflets lineolate both sides, minutely punctate beneath; *leaf-spurs* 0.3–0.5 mm long; *stipules* broadly triangular or ovate, short-acuminate, up to 1 mm long, submembranous, the margins denticulate; *intrapetiolular gland* minute, spiculiform; *post-petiolular glands* very prominent, slenderly subulate, pale-yellow or reddish; *main cauline leaves* sessile, (0.6) 1–2.2 (3) cm long, with strongly margined, eglandular rachis and 7–14 (17) pairs of oblong-oblanceolate to -obovate, emarginate to deeply retuse, thick-textured, boat-shaped but not closely folded leaflets 0.6–2.5 mm long, the terminal leaflet usually a little longer than the last pair, the lowest 2 pairs often approximate at base of rachis (one pair on pulvinus), the rameal (rarely all) leaves shorter, with fewer (4–7 pairs), smaller leaflets; *peduncles* subfiliform, (1) 1.5–5 cm long; *racemes* very loosely 2–7 (the uppermost sometimes 1)-flowered, the flowers at first ascending, soon spreading or declined, the glabrous axis becoming ± 1–2 cm long; *bracts* enfolding the young buds, early caducous from a thickened but hardly decurrent spur, obovate-apiculate, membranous or papery, (1) 1.5–2.5 mm long, finely glandular dorsally, the margins denticulate; *pedicels* 0.4–0.9 mm long, pilosulous, charged at apex with minute gland-grains; *calyx* at anthesis 4.3–5.2 mm long, a little accrescent and 4.5–7 mm long in fruit, the tube at anthesis 2.2–2.6 mm long, pilosulous along the prominent ribs with straight, ascending, lustrous hairs up to 0.4–0.6 mm long, the pale but firm intervals charged below the middle with 1–3 linear-elliptic, externally bullate glands, the plane, herbaceous, more thinly pubescent or glabrescent teeth about as long as tube or finally a trifle longer, subhomomorphic but the dorsal one a trifle the shortest, the sinuses about equally deep, all prominently 3-nerved and then reticulate (especially in age), the margins sharply (3) 5–9-toothed; *petals* eglandular, pallid, the banner

whitish with sometimes pink basal lobes and faintly rubescent, mostly included in the calyx-tube, the inner pairs bluish-lilac, inserted 0.6–1.3 mm above hypanthium rim; *banner* 2–2.8 mm long, the claw 0.7–1.5 mm, the strongly recurved, reniform-emarginate or shallowly 4-lobed blade 1.3–1.8 mm long, 2–2.4 mm wide; *wings* 3.7–4.7 mm long, the claw 0.8–1 mm, the obovate blade 3–4 mm long, 1.7–2.8 mm wide; *keel* 3.9–4.9 mm long, the claws 0.6–1.1 mm, the broadly obovate blades 3.3–4.3 mm long, 2–2.9 mm wide; *androecium* (9) 10-merous, 4.4–5.6 mm long, the longer filaments free for 1.2–1.4 mm, the connective glandular, the bluish anthers (some sometimes abortive) 0.4–0.55 mm long; *pod* 2.5–3 mm long, ± harp-shaped, strongly compressed, crested dorsally beyond the pore, the prow slender but carinate, the persistent style-base 0.5–0.7 mm long, the valves in lower ⅓ smooth but not hyaline, thence thinly pilosulous, charged around the distal margin with a row of small glands and near the middle with crescent of the same; 2n = 20 (Mosquin). — Collections: 20 (ii).

In thin stony soil of rocky hills and among sparse brush in oak woodland, usually associated with low grasses, 600–1530 m (2000–5100 ft) or in Guatemala 200–500 m, local but forming colonies, widely dispersed over the Balsas Depression from s. México and adjoining Guerrero to s. Michoacán, s. interruptedly to centr. Oaxaca, and apparently disjunctly in Nayarit (Sierra de Nayarit near Jesús María), and in desert along Río Motagua in Zacapa, Guatemala. — Flowering August to December. — *Representative*: MEXICO. NAYARIT: *Feddema 1249* (MICH). MICHOACÁN: *Hinton 13,294* (ARIZ, MICH, TEX, W), *15,248* (ARIZ, TEX, W); *Ripley & Barneby 14,832* (CAS, NY). GUERRERO: *Pringle 13,516* (ARIZ, F, L, MICH, OKLA, TEX); *Hinton 9409* (F, MEXU, NY); *Kruse 561* (ENCB). MÉXICO: *Matuda 31,309* (MEXU); *Hinton 1750* (F, K, MEXU, NY). OAXACA: *Rzedowski 21,361* (ENCB); *Ripley & Barneby 14,694* (CAS, DAO, F, GH, MICH, MEXU, US). GUATEMALA. ZACAPA: *Standley 74,399* (F, NY); *Steyermark 29,354* (F, NY).

Marina gracilis (slender) Liebmann, Vidensk. Meddel. **1853**: 103. 1853. — "Habitat in campis sterilibus aridis pr. Ejutla in valle Oajacana Octob. florens et fructificans." — Holotypus, presumably C, not seen; isotypi (*Liebmann 4577*), F, NY! paratypus (*Liebmann* 4589), F!

Parosela delicata (delicate) Rose, Contrib. U. S. Nat. Herb. **8**: 304. 1905. — "Collected by C. G. Pringle on dry hills near Iguala, Guerrero, altitude 780 meters. September 14, 1900 (no. 8442)." — Holotypus, US! isotypi, GH, L, M, MEXU, NY, UC, W, Z! — *Dalea delicata* (Rose) Greenm., Field Mus., Bot. **2**: 331. 1912.

The generitype of *Marina, M. gracilis*, is taxonomically isolated, notable among other annual congeners for the combination of slender but wiry stems, numerous small, glabrous, boat-shaped leaflets, openly few-flowered racemes, straight, lustrous hairs on the calyx-ribs, and sharply dentate calyx-teeth. This last feature is unique, but several members of ser. *Chrysorrhizae* do have the dorsal tooth incipiently lobulate on either side. The banner of *M. gracilis* resembles that of several *Unifoliolatae*, and its pod, though of firmer texture, that of the likewise isolated and xerophytic *M. vetula*, which also has straight calyx-hairs, but teeth entire. Hutchinson (1964, p. 419) maintained *Marina* as a monotypic genus within his narrowly defined tribe Psoraleeae, evidently having overlooked the epistemonous insertion of the inner petals, long ago correctly described by Rydberg. In Rydberg's monograph (1919, p. 51) *M. gracilis* appears under the taxonomic synonym *Parosela delicata* Rose only because the epithet *gracilis* is preoccupied in *Parosela*. There, as here, the species forms a monotypic group.

In two stations where I have collected *M. gracilis*, the plants formed colonies of many hundreds of individuals growing close together so as to form interwoven mats of stems, but were restricted to ridges where the soil was particularly shallow and stony, affording foot-

hold to few other plants, although there must have been a thin mantle of grasses early in the year. By November such places are becoming extremely dry and the plants are largely defoliated, although still conspicuous because of the multitude of thin red stems, and still actively flowering and fruiting. Very likely as such unpromising localities are more thoroughly scrutinized at the proper season, the apparently discontinuous range of *M. gracilis* will be considerably filled out. It is certainly to be expected in Jalisco and Chiapas.

A(vi). Series Crenulatae Barneby

Essentially as ser. *Chrysorrhizae*, but totally glabrous (the calyx of one variety of *M. neglecta* pectinately ciliolate); resembling sect. *Carroa* in habit and glabrous foliage, but differing in the strongly compressed pod with valves not distended by or adherent to the seed and charged with definite crescentic gland-patterns. — Species 4, 3 perennial, herbaceous or suffruticose, 1 annual, of w. and s. Mexico, one weedy.

Marina sect. **Marina** ser. **Crenulatae** Barneby, ser. nov., ser. *Chrysorrhizis* praesimiles nisi toto glabrae, a sect. *Carroa* (etiam glaberrimae) legumine compresso de latere glandulis lunatim dispositis ornato gravius divergentes. — Sp. typica: *M. crenulata* (H. & A.) Barneby.

Separation from sect. *Carroa* of a ser. *Crenulatae* in sect. *Marina* draws attention to the fact that *Parosela* sect. *Diffusae* Rydb., characterized by complete lack of pubescence, even around the mouth of the calyx, conceals within it two distinct groups of species, one with the compressed pod of ser. *Chrysorrhizae*, the other with nutlike pod filled by the seed and glandular all over. Until the pod takes form, the two groups cannot be distinguished, all having similar green foliage and bright magenta flowers. The ser. *Crenulatae* is perhaps not entirely natural. The first species, *M. neglecta*, is ambiguously intermediate between ser. *Crenulatae* and ser. *Unifoliolatae*, the typical var. *neglecta* having the pectinately ciliolate calyx of the latter series, while its var. *elongata* is totally glabrous. It might be preferable to transfer *M. neglecta* to ser. *Unifoliolatae*, but it would be the only member of that series with either a perennial root or a gland-sprinkled banner. The type-species of the present series, *M. crenulata*, is a tall herb with lignescent, wandlike stems; the poorly known *M. dispansa* is apparently fruticose and diffuse; and *M. sarodes* is an erect, monopodial annual. In habit and duration the *Crenulatae* are a motley assembly, but are alike in fine detail of flower and fruit.

27. Marina neglecta (B. L. Robinson) Barneby
(Plate XIX)

Herbaceous from a tough, orange-red, perennial root, variable in stature, flowering when (1.5) 3–15 dm tall, the diffusely ascending to erect, densely but minutely gland-tuberculate stems branching from the base, from near the middle, or only distally, glabrous below the spikes or (var. *elongata*) glabrous throughout, the leaflets bicolored, green and smooth above, paler, lineolate, and gland-punctate beneath, the often reddish margins ± gland-crenulate; *leaf-spurs* less than 1 mm long; *stipules* ovate-deltate, 0.3–1 mm long, minutely fimbriate; *intrapetiolular gland* 1, spiculiform; *post-petiolular glands* small but prominent; *main cauline leaves* 2–4.5 (5) cm long, shortly petioled, with very narrowly margined rachis and 4–8 (9) pairs of oblong-elliptic to oblanceolate, obtuse and gland-mucronulate or subacute, flat or loosely folded leaflets 4–8 (10) mm long, the terminal leaflet stalked beyond and a trifle

larger than the last pair; *peduncles* leaf-opposed and terminal to branchlets, 1.5–6 (8) cm long; *racemes* most commonly rather dense (calyces separated, when pressed, by gaps narrower than themselves, or overlapping), but not rarely loose and open, (15) 20–95-flowered, the flowers spreading and loosely declined from erect pedicels, the axis becoming (1.5) 2–17 cm long; *bracts* early deciduous, submembranous, purplish, ovate-caudate above the cuneate base, 1.5–2.5 mm long, glandular and sometimes minutely puberulent dorsally, fimbriolate-margined; *pedicels* (0.5) 0.6–1 mm long; *calyx* 3.2–4 mm long, pectinately ciliolate from the base upward, or only from base of the teeth upward, with forwardly incurved hairs up to 0.1–0.25 mm long, rarely quite glabrous, the tube 1.5– 2 mm long, at first strongly pleated, the membranous intervals between the prominent ribs charged with 5–8 small glands arranged in one vertical rank, the orifice subsymmetrical, the plane, herbaceous, narrowly ovate to lanceolate teeth little unequal, the dorsal one only a trifle the longest, (1.2) 1.4–2.1 mm long; *petals* bicolored, the banner opening white except for purple basal lobes, rubescent, the inner ones (inserted 0.7–1.4 mm above hypanthium-rim) vivid magenta-violet, the banner and keel charged with a few scattered glands; *banner* 2.4–4.3 mm long, the claw 1.2–1.8 mm long, the blade abruptly recurved through ± 90°, ovate to ovate-oblong, sometimes shallowly 4-lobed, emarginate, closed at base into a shallow cornet, 2.3–3 mm long, 2.2–3.4 mm wide; *wings* 4.1–5 mm long, the claw 0.7–1 mm, the oblong-obovate blade 3.4–4.4 mm long, 1.9–2.8 mm wide; *keel* 4.5–5.3 mm long, the claws 1.2–1.5 mm, the obliquely obovate blades 3.4–4.2 mm long, 2.3–2.8 (3) mm wide; *androecium* 10-merous, 5–6.3 mm long, the longest filaments free for 1.4–2 mm, the bluish, gland-tipped anthers 0.5–0.6 mm long; *pod* compressed, harp-shaped, 2.4–2.9 mm long, the short style-base lateral but only a little below the apex, the dorsal suture prominent distally but slender, the valves hyaline at base, in the upper ⅔ papery and charged with 2 inverted crescents of few but relatively large blister-glands, the ventral keel and style-base commonly puberulent but ovary and pod sometimes quite glabrous; *seed* ± 1.8–2.1 mm long.

Because *M. neglecta* consists of two races, one (var. *neglecta*) with leaves glabrous but calyx densely ciliolate, the other (var. *elongata*) glabrous throughout, the whole species cannot be distinguished from all sympatric members of the genus by one neat diagnostic phrase. The common var. *neglecta* shares its range with only one other *perennial* marina with pubescent calyx: the pliantly humifuse *M. procumbens*, distinct in its habit of growth, pilosulous stems, and pink-purple, not magenta-violet, petals. Flowering specimens of var. *elongata* invite comparison with similarly hairless members of sect. *Carroa*, notably with *M. nutans*, like it in the arrangement and vivid hue of the flowers. At a later stage of growth *M nutans* develops the little-compressed, nutlike pod charged all over with scattered blister-glands that characterize its section, but in early anthesis may be distinguished from *M. neglecta* var. *elongata* by the many leaflets (more than 10 pairs) of the main cauline leaves. The real affinity of *M. neglecta* is uncertain. It can be visualized as combining the inflorescence, coarse habit, and gland-sprinkled banner of *M.* (*Carroa*) *nutans* with the calyx of *M.* (*Marina* ser. *Unifoliolatae*) *melilotina* and its close allies, all of which, however, are obligately monocarpic. A curious feature of *M. neglecta* is its erratic, weedy pattern of dispersal. Although now a common and locally abundant species that follows the road shoulders of several of southern Mexico's main highways for miles on end, it was collected first only in 1890, having been missed, apparently, by all the earlier naturalists. At Guanajuato, the type-locality, I was unable to trace the colonies back from the hedgerows into a less disturbed habitat, and in ten other places where I have seen var. *neglecta* the same conditions held. The species appears to be on the march, and its aboriginal dwelling is unknown.

Supposing that the weedy dispersal and the morphological variation of a type unusual in *Marina* are somehow causally related, I would suspect that *M. neglecta* is a species of recent origin, one that arose, perhaps, in the first instance as a fertile hybrid between members of the two sections, *Marina* and *Carroa*. Like the cornfield weeds of Europe, it seems to persist only in man-created habitats. If originally a hybrid, its progeny might be expected to give rise to recombinations of parental characters, and some ambiguous populations seem to fill this role. These are mentioned in detail under the two varieties described below.

Key to the Varieties of *Marina neglecta*

1. Plant glabrous to the inflorescence, the raceme-axis pilosulous, the calyx pectinately ciliolate, usually from the base upward, always on the teeth; *stems* usually incurved-ascending, mostly 3–7 dm long; *racemes* usually compact, the flowers approximate or contiguous in pressed specimens; range of the species (Guanajuato to Jalisco and Oaxaca). 27a. var. *neglecta*.
1. Plant glabrous throughout; *stems* erect and ascending 5–15 dm tall; *racemes* usually open, the flowers distant or becoming so; local in the eastern part of the Balsas Depression, in Morelos and adjoining Guerrero and Puebla. 27b. var. *elongata*.

27a. Marina neglecta (B. L. Robinson) Barneby var. neglecta (Plate XIX)

Stems usually numerous from the root-crown, branching from near the base or near the middle, forming leafy clumps often broader than high; *raceme mostly* 20–50 (rarely up to 70)-flowered, the axis usually 2–6.5 (exceptionally up to 17) cm long; *pod* puberulent distally; n = 10 (Spellenberg, 1973); 2n = 20; 10_{II} (Mosquin). — Collections: 26 (x).

Stony and grassy roadsides and banks of hedges, colonial and sometimes forming continuous or irregularly interrupted edging to the highway for up to 20 km in length, occurring only rarely and weakly in grazed grassland or in arid scrub, not certainly known from any undisturbed habitat, (300) 1200–2250 m, locally common in three apparently separated areas: grasslands of the Bajío, n. Michoacán to centr. Guanajuato, w. to extreme s. Zacatecas, central and n.-e. Jalisco and Aguas Calientes; arid valleys of centr. Oaxaca, extending n.-w. along the Pan-American Highway into s.-w. Puebla, and (perhaps isolated) along the Acapulco Highway near Chilpancingo, Guerrero; arid gypseous hills at low elevations in Colima. — Flowering from August to December. — *Representative*: Zacatecas: *Mahler 5849* (NY). Jalisco: *Ripley & Barneby 14,135* (NY). Aguas Calientes: *Robt. Pearce 2289* (OKLA). Guanajuato: *Ripley & Barneby 13,341* (CAS, MEXU, NY, US), *13,350* (K, MEXU, NY). Michoacán: *Mosquin 6782* (DAO, NY); *Ripley & Barneby 14,131* (CAS, DAO, NY). Guerrero: *Rowell et al. in 1947* (F). Puebla: *Iltis & Koeppen 1129* (MICH, US, WIS). Oaxaca: *Ripley & Barneby 13,658* (CAS, MEXU, MICH, NY, US); *Mosquin 6669* (DAO, NY). Colima: *Gentry, Barclay & Arguelles 19,560* (RENNER, US); *McVaugh & Koelz 1073* (MICH).

Marina neglecta (B. L. Robins.) Barneby, Phytologia **26**: 2. 1973, based on *Dalea neglecta* (overlooked) B. L. Robins., Proc. Amer. Acad. **29**: 329. 1894. — "Collected at

Guanajuato, Mexico, by Prof. Alfred Duges (no. 2576)." — Holotypus, *Dugès 257 B* (not *2576*), GH! — *Parosela neglecta* (B. L. Robins.) Rose, Contrib. U. S. Nat. Herb. **8**: 304. 1905.

The form of var. *neglecta* common in the grasslands of the Lerma valley between Lago Cuitzeo and Lago Chapala in northern Michoacán has many incurved-ascending stems about 3–7 dm long unless dwarfed by crowding, deep green foliage at first ample but becoming thin as the season advances, and very numerous flowers arranged in dense racemes which seldom surpass six cm in length, even when in fruit. The vivid magenta-purple petals are less fugitive than those of *M. scopa*; in consequence several successive flowers on a raceme remain open at a time, and the young plant in full anthesis is a colorful sight. In this area, as also in Jalisco and Guanajuato, the calyx is pectinately ciliolate from the base upward, although a minor variant with glabrous calyx-tube and only puberulent calyx-teeth, suggesting passage to var. *elongata*, has been collected in central Jalisco (near Estipac, *Schubert & Souza 1966,* NY). The typical form is also abundant here and there along the Pan-American Highway between Oaxaca City and Southern Puebla. In the valley of Oaxaca near Etla I found plants identical in general aspect and growing close together, some with ciliolate, others with quite glabrous calyces. The latter (*Ripley & Barneby 14,625a*, NY) would key to var. *elongata* but are interpreted as a second minor variant of var. *neglecta*. At low elevations near Colima, in gypseous soil at ± 300 m, var. *neglecta* is represented by yet another variant (*Gentry et al. 19,560*, US). In this the calyx is typical of var. *neglecta* but the raceme is loose and up to 70-flowered, its axis reaching in some specimens a length of 17 cm, thereby resembling var. *elongata* in habit of growth. Probably representing the same taxon, which may deserve formal varietal status, are gigantic plants ("to 6 ft tall, used for brooms") collected on sandy flats behind the beach 10 km s.-w. of Tocoman, Colima (*Spellenberg & Dunford 2954*, NY), which I would have referred to var. *elongata* except that the calyx is strigulose.

27b. MARINA NEGLECTA (B. L. Robinson) Barneby var. ELONGATA (Rose) Barneby

Stems ascending and erect, 5–15 dm tall, often paniculately branched distally; *raceme* loosely 20–95-flowered, the axis becoming (2) 4–16 cm long; *pod* glabrous; n = 10 (Spellenberg, 1973). — Collections: 4 (ii).

Colonial in disturbed soil on brushy waysides, at edge of milpa, and on streambanks, 900–1530 m, local about the e. edge of the Balsas Depression, in Morelos and adjoining Guerrero and Puebla. — Flowering late August to December. —*Material*: MORELOS: Jojutla (type); Lago Tequesquitengo, *Ripley & Barneby 13,712* (NY). GUERRERO: Tinajas, dist. Coyuca, *Hinton 5846* (NY, Z). PUEBLA: Tehuitzingo, *Ripley & Barneby 13,688* (CAS, K, MEXU, MICH, NY, US).

Marina neglecta (B. L. Robins.) var. **elongata** (Rose) Barneby, Phytologia **26**: 2. 1973, based on *Parosela elongata* (long, of the raceme) Rose, Contrib. U. S. Nat. Herb. **8**: 306. 1905. — "Collected by Mr. C. G. Pringle at Jojutla, Morelos, August 30, 1902 (no. 11,365)." — Holotypus, US! isotypus, GH! — *Dalea elongata* (Rose) Bullock, Kew Bull. **1939**: 196. 1939.

Because it was entirely glabrous, Rydberg placed *Parosela elongata* in his sect. *Diffusae* (1919, p. 60), unduly remote from *P. neglecta* in sect. *Chrysorrhizae* (Rydberg 1919, p. 51). At the time each species was known only from the type collection, and even if the similarities in all features except that of vesture had been noticed, no one could have foreseen how future collecting would devaluate even this, apparently so decisive a differential character. As I have seen var. *elongata* in Morelos and Puebla, it formed on the average a

taller and more erect plant than var. *neglecta*, with longer and more open racemes of flowers that proved, on close examination, identical with those of var. *neglecta* except for the lack of stiff incurved hairs on the calyx-tube and -teeth. In the Puebla station already cited, colonies of var. *elongata* grew in close contact with *M. melilotina*, a species similar in its open raceme and erect, paniculate habit of growth, as well as in details of the foliage and in coloring of the flower. However the raceme of *M. melilotina* is composed of only ± 7–20 flowers, the root is annual, and the glandless blade of the banner is open at the base. The calyx of *M. melilotina* is densely pectinate-ciliolate like that of typical *M. neglecta*, a character immediately noticed in the field.

28. Marina crenulata (Hooker & Arnott) Barneby (Plate XXI)

Tall erect, suffrutescent herbs from a tough woody root, with 1–several, at first herbaceous but at length lignescent, wandlike stems up to 6–20 dm long, glabrous throughout, the stems livid-castaneous and usually glaucous, finely striate but smooth and eglandular, the main axis appearing simple up to the small, few-branched, terminal panicle, the inflorescences mostly terminal to short-shoots or leafy spurs issuing from axils of drought-deciduous cauline leaves, the foliage bicolored, the leaflets green above, pallid and punctate beneath, lineolate both sides, the margins impressed-glandular-crenulate; *leaf-spurs* 0.4–0.8 mm long; *stipules* 0.5–3 mm long (variable according to var.); *intrapetiolular gland* subulate or spiculiform; *post-petiolular glands* subulate, acute, very prominent; main cauline leaves (seldom present on flowering material) 1.5–2.5 cm long, subsessile, with strongly veined rachis and 9–14 pairs of narrowly oblong, obtuse but gland-mucronate, flat leaflets 2–4 mm long, the rameal leaves usually crowded on lateral spurs 0.3–4 cm long, shorter than the primary cauline ones, mostly 0.5–2 cm long, with only 3–7 (9) pairs of leaflets mostly (0.5) 1–2 mm long; *racemes* mostly terminal to short-shoots, sessile or subsessile, (3) 6–20-flowered, but a few (early in the season) terminating branchlets of a terminal panicle and these pedunculate and up to 30-flowered, the flowers loosely spreading or a trifle declined, the axis (0.2) 0.5–2.5 (3) cm long; *bracts* early deciduous from spurs decurrent on the axis, broadly lanceolate to ovate-acuminate, boat-shaped, brown and papery, sparsely glandular dorsally, pectinately ciliolate; *pedicels* 0.6–1 mm long, charged at apex with a pair of gland-grains; *calyx* (4) 4.5–6.2 mm long, glabrous, the brownish tube (1.2) 2.2–3.5 mm long, strongly pleated, the rather firm intervals charged with one row (or below the broad ventral teeth two rows) of 7–13 (17), rarely only 3 small yellowish glands, the plane herbaceous teeth dissimilar, the dorsal one broadly lance-ovate, 2.1–3 mm long, the ventral pair deltate-ovate, about twice broader and somewhat shorter than the dorsal one, the lateral pair intermediate, the bases of all teeth imbricate (dorsal exterior on both sides, laterals exterior to ventrals), the margins narrowly membranous-margined and minutely gland-serrulate or -crenulate, the orifice subsymmetrical; *petals* magenta-purple, the banner white centrally and distally, often gland-sprinkled, the keel-blades paler along their outer edge, the inner petals perched (1.2) 1.7–3.6 mm above hypanthium rim; *banner* 2.7–4.7 mm long, scarcely or not much exserted, the claw 1.3–3 mm long, the deltate-cordate or subquadrate blade 1.8–2.8 mm long, 2.6–3.4 mm wide, closed across top of claw to form a cornet; *wings* 3.7–5 mm long, the claw (often inversely subulate) 0.3–0.7 mm, the obovate blade 3.6–4.6 mm long, 2.7–3.2 mm wide; *keel* (5) 5.3–8.1 mm long, the claw 1.1–1.9 mm, the broadly oblong-obovate blade (4.4) 4.9–6.3 mm

long, 3.2–4.9 mm wide; *androecium* 10-merous, 6.9–10.2 mm long, the longer filaments free for 1.7–2.3 mm, the connective gland-tipped, the bluish anthers 0.7–0.95 mm long; *pod* (glabrous) obovate or incipiently harp-shaped in profile, substipitate at base, ± 2.5 mm long, the short style-base terminal but excentric, carinate dorsally above the pore and also ventrally, the valves membranous at very base, thence firm and charged with 2 (3) crescents of blister-glands.

In the field *M. crenulata* is recognized by its habit of growth, unlike that of related species. The mature plant consists of one or several tall and coarse, wandlike stems which branch distally into a disproportionately small, few-branched panicle of racemes. These, however, are flowers found only at the beginning of the dry season, when much of the primany cauline foliage still clothes the upper half of the usually purplish-glaucescent stem. The main crop of flowers does not appear before late January, in the form of densely, often subcapitately few-flowered racemes borne sessile on little leafy spurs axillary to the main cauline leaves which have dried up and fallen away. This type of inflorescence, appearing late in the dry season, is strikingly simulated by sympatric forms of *Dalea versicolor*, but is not otherwise matched in *Marina*. In the herbarium *M. crenulata* is sometimes confused with *M. nutans*, in which all the flowers, similar in form and coloring, are arranged in a panicle of loosely flowered racemes. The suffruticose and glabrous marina common in the range of *M. crenulata* is *M. diffusa*, but this is entirely different in its effuse, broad-headed inflorescence of distantly few-flowered racemes borne on filiform, pliant branchlets.

The range of typical *M. crenulata* along the Pacific slope from southern Sonora to western Jalisco is fairly well documented. There is one record for coastal Guerrero (río Tecpan), apparently typical, and another from coastal Oaxaca, this remarkable for its enlarged, persistent stipules, relatively well-developed terminal panicle, few calyx-glands, and small flowers. The latter seems to differ sufficiently to deserve taxonomic recognition, but its status will obviously require revision as more material of *M. crenulata* from the coastal lowlands of Sierra Madre del Sur becomes available.

Key to the Varieties of *Marina crenulata*

1. Stipule-blades triangular-subulate, 0.5–1 mm long, early deciduous; *intervals* of calyx charged from base to tip with a chain of 7–13 (17) glands; s. Sonora to w. Jalisco; apparently isolated on the coast of Guerrero. 28a. var. *crenulata*.
1. Stipule blades lanceolate, membranous, pallid, 2–3 mm long, persistent; *intervals* of calyx charged with a row of ± 2–3 glands situated above middle of tube; s. Oaxaca. 28. var. *stipulacea*.

28a. Marina crenulata (Hooker & Arnott) Barneby var. crenulata

(Plate XXI)

Stems 6–20 dm long, simple except for a few short branches distally, usually livid and glaucescent; *flowers* variable in size, the keel-blades mostly 5–6.3 mm long. — Collections: 16 (i).

Dry grassy hillsides, ascending from coastal brush and short-tree xeric woodland into the lower edge of the oak-belt, 75–1700 (1900) m (± 250–6300 ft), local but forming extensive colonies, along the Pacific slope of Sierra Madre from s. Sonora (Sierra de Alamos) and s.-w. Chihuahua (Sierra Charuco) to w. Jalisco, extending

inland along the valley of Río Grande de Santiago almost to Guadalajara; apparently disjunctly on s. slope of Sierra Madre del Sur in s.-centr. Guerrero. — Flowering from November onward, the main bloom from January to April. — *Representative*: SONORA: *Palmer 385* (ARIZ, MEXU, NY, US). CHIHUAHUA: *Gentry 8069, 8112* (MICH, NY, UC). SINALOA: *Gentry 5814* (ARIZ, MICH, NY), *7313* (GH, NY). NAYARIT; *Palmer 1974* (ARIZ, NY); *Ripley & Barneby 14,033* (CAS, NY); *Jones 23,066* (NY, UC). JALISCO: *Mexia 1881* (F, GH, NY, UC); *McVaugh 8884* (ENCB). GUERRERO: *Langlassé 819* (MEXU).

Marina crenulata (Hook. & Arn.) Barneby, comb. nov., based on *Dalea crenulata* (crenulate, of the calyx-teeth) Hook. & Arn., Bot. Beechey Voy. 285. 1836. — "Found at Talisco [= Jalisco, Nayarit]." — Holotypus, so labelled, K. (herb. Hook.)! = *Univ. Mich. Neg. 521*! — *Parosela crenulata* (Hook. & Arn.) Rose, Contrib. U. S. Nat. Herb. **8**: 306. 1905.

28b. MARINA CRENULATA (Hooker & Arnott) Barneby var. STIPULACEA Barneby
(Plate XXI)

Stems up to 1 m tall, not glaucescent, paniculately branching distally; *flowers* relatively small, the calyx ± 4 mm, the keel-blades ± 4.4 mm long; otherwise as in the key. — Collections: 1 (typus).

Ravines in the foothills, 350 m, s. slope of Sierra Madre del Sur in s.-w. Oaxaca. — Flowering January to March.

Marina crenulata (Hook. & Arn.) Barneby var. **stipulacea** (with large stipules) Barneby, var. nov., a var. *crenulata* (hucusque allopatrica) praesertim stipularum lamina elongata persistenti (foliorum majorum 2–3 mm longa) necnon calycis tubo tantum supra medium glandulis parvulis impressis in utroque intervallo ± 3 (nec 7–17) ornato absimilis. — OAXACA. Putla: ravine bordering rapid stream, now mostly cleared and pastured, 350 m, scarce, Feb 5, 1965, *Rogers McVaugh 22,224*. — Holotypus, MICH; isotypus, ENCB.

29. MARINA DISPANSA (Rydberg) Barneby
(Plate XXII)

Shrubby, repeatedly and irregularly branching, the stature and attitude of the stems unknown but apparently diffuse with flexuously incurved branchlets, glabrous except for the fimbriolate stipules, bracts, and calyx-teeth, the stems livid-castaneous, remotely low-verruculose, the leaflets strongly bicolored, green above, pale and minutely gland-punctate beneath, their margins subrevolute, gland-crenulate, 3–5-denticulate at apex; *leaf-spurs* 0.3–0.6 mm long; *stipules* deltate, up to 0.5 mm long; *intrapetiolular gland* linear-subulate; *post-petiolular glands* very prominent, slender-subulate; *main cauline leaves* sessile or nearly so, ± 2.5–3 cm long, with narrowly margined rachis and 8–10 pairs of oblong or oblong-obovate, subtruncate, basally subcordate, gland-mucronulate leaflets 4–7 mm long, the rameal leaves shorter, with ± 4–6 pairs of leaflets of same shape but only 2–4.5 mm long; *peduncles* mostly terminal to branchlets, a few leaf-opposed, 1–6 mm long; *racemes* shortly but loosely (4) 6–10-flowered, the flowers patent and declined, the axis ± 4–9 mm long; *bracts* embracing the young buds but early deciduous, ovate, short-acuminate, 1.5–2 mm long, submembranous,

slender-keeled and minutely glandular dorsally; *pedicels* (0.5) 0.6–0.8 mm long, charged near apex with 2 prominent glands; *calyx* 3.6–4 mm long, the broadly campanulate, pleated tube 2.2– 2.5 mm long, the ribs slender but prominent, the submembranous intervals charged with a chain of ± 7–9 small, golden glands, the orifice subsymmetrical, the plane, herbaceous teeth ovate-deltate, tentacular-fimbriolate, their broad bases ± imbricate, the dorsal one 1.2–1.7 mm long, the ventral pair a little shorter and broader; *petals* apparently pink-purple, the strongly brown-veined banner perhaps opening whitish, the inner ones elevated 1.8–2.4 mm above the hypanthium rim, the banner and keel charged with a few small glands; *banner* 4–4.3 mm long, the claw 1.8–2 mm, the ovate, basally cordate, deeply emarginate blade recurved through 90°, 2.8–3.1 mm long, 2.2–2.6 mm wide, recessed at base into a cornet; *wings* 3.8–4 mm long, the claw 0.3–0.5 mm, the obovate blade 3.4–4 mm long, 2.4–2.8 mm wide; *keel* 5.2–5.8 mm long, the claws 1.3–1.7 mm, the blades 3.9– 4.5 mm long, 3–3.2 mm wide; *androecium* 10-merous ± 6.5 mm long, the longest filament free for 1.2–1.9 mm, the bluish, gland-tipped anthers 0.65–0.7 mm long; *pod* ± 2.5 mm long, not known fully ripe, apparently asymmetrically obovoid with terminal but excentric style-base, crested dorsally in the upper half, keeled along the leading edge ventrally, the firm, glabrous valves charged with two subvertical gland-crescents. — Collection: 1 (typus).

Oakwoods, around 1200 m ("4400–5000 ft"), known only from the type-locality at Talpa de Allende, on or near the Pacific slope in extreme western Jalisco. — Flowering February and March.

Marina dispansa (Rydb.) Barneby, comb. nov., based on *Parosela dispansa* (diffuse) Rydb., N. Amer. Fl. **24**: 59. 1919. — "Type collected in the mountains near Talpa, Jalisco, March 7, 1897, *E. W. Nelson 4034...*" — Holotypus, US! isotypus, NY!

The specific status of *M. dispansa* will remain insecure until more can be learned about its stature, growth-habit, and range of dispersal. Rydberg contrasted it directly only with *Parosela submontana* (= one aspect of our *Marina nutans*), but it appears much more closely related to *M. crenulata*, which it resembles in details of the pleated, multiglandular calyx, the petals, and the fully formed but unripe pod. The whole flower of *M. dispansa* is small compared with the average flower of *M. crenulata*. The latter extends southward along the Sierra Madre Occidental and has been collected close to Talpa where it is represented by a form (*Mexia 1881*) characterized by uncommonly small flowers, although these are associated with the coarse wandlike stems typical of *M. crenulata*. It seems possible that the typus of *M. dispansa* will prove to be an abnormal or at least an unusual, diffusely and tortuously branching state of *M. crenulata*. It possesses, however, some small features not yet met with in its relative: slightly fewer, larger leaflets of thinner texture, fimbriolate across the top; narrowly margined leaf-rachis; coarsely striped banner. The ripe pod may yet show differences in texture of the valves and pattern of the glands. The nearly sympatric *M. grammadenia* is more easily distinguished by its large banner open at the base and the nutlike pod charged all over with large blister-glands.

30. Marina sarodes Barneby

(Plate XXI)

Tall, slender, erect annual herbs from an orange root, paniculately branching distally (with habit of *M. scopa*), glabrous throughout, the almost eglandular, smooth stem livid becoming stramineous distally, the foliage bicolored, the leaflets green above, pallid and sparsely punctate beneath, lineolate; *leaf-spurs* 0.4–0.7 mm long; *stipules* 1–1.5 mm long, gland-fimbriolate; *intrapetiolular gland* small; *post-petiolular*

glands small but prominent, conic, orange; *leaves* subsessile, the main cauline ones 2.5–4 cm long, with narrowly margined rachis and 8–16 pairs of narrowly oblong or oblong-oblanceolate, flat, minutely gland-crenulate leaflets 3–6 mm long, the leaves of the inflorescence abruptly smaller, 5–15 mm long, with only 1–3 (4) pairs of oblanceolate to narrowly oblong leaflets; *racemes* 5–11-flowered, the lower flowers separated by a distance longer than their pedicels, the distal ones more crowded, the axis becoming 1–2.5 cm long; *pedicels* 0.6–1 mm long; *calyx* 3.4–3.6 mm long, the firm, purplish tube 1.9–2.1 mm, charged in each interval with a row of 2–3 small glands, the teeth green with narrow, pallid, erose margins, dissimilar, the dorsal one longest, narrowly ovate, 1.4–1.6 mm long, the ventral pair shorter, broadly obovate; *petals* bicolored, the banner white with purple-tipped basal lobes, rubescent, the inner bright magenta-purple, perched 1.5–2 mm above hypanthium rim, the blades of banner and keel sparsely gland-sprinkled; *banner* 3.2–3.7 mm long, the rather thick claw 1.3–1.6 mm, the obtusely deltate-obcordate blade recurved through ± 50°, closed across the top of the claw to form a shallow cornet; *wings* 4.7 mm long, the claw 0.3 mm, the blade horizontal to keel at full anthesis, broadly obovate, 4.6 mm long, 3 mm wide; *keel* 6 mm long, the claw 1 mm, the broadly oblong-obovate blade 5.3 mm long, 3.1 mm wide; *androecium* 10-merous, 6 mm long, the longest filament free for ± 1.5 mm, the connective gland-tipped, the anthers 0.6 mm long; *ovary* charged with small glands arranged in 1 transverse and 1 subvertical crescent, the forming pod compressed, not seen ripe. — Collection: 1 (typus).

Brushy slopes in oak woodland, ± 900 m (3000 ft), known only from one station in the e. end of the Transverse Volcanic Belt in s. Nayarit. — Flowering October and November, possibly later.

Marina sarodes (broomlike, in habit resembling the broom marina *M. scopa*) Barneby, sp. nov., inter ser. *Crenulatas* radice annua, caule solitario erecto ultra medium paniculatim ramoso insignis. Annuas sect. *Carroae* species *M. minutifloram* necnon *M. scopam* habitu simulans sed ab illa caulibus elatis floribusque majoribus, ab hac vexilli lamina ampliori emarginata peltata, ab ambabus leguminis ut videtur compressi valvulis more seriei suae glandulis lunatim ordinatis nec conspersis ornatis gravius discrepat. — NAYARIT. Jalisco: steep brushy oakwoods, 3000 ft., 11 mi. s. of Jalisco, oct 8, 1965, *Ripley & Barneby 14,044.* — Holotypus, NY; isotypus, CAS.

Granted that *M. sarodes* is correctly referred to ser. *Crenulatae*, as suggested by the crescentic gland-patterns on the young pod, it is a most distinct species, easily and immediately distinguished from *M. crenulata* and *M. dispansa* by its annual, monopodial growth-habit, and from *M. neglecta* further by its many pairs of leaflets in main cauline leaves. In habit it resembles some species of sect. *Carroa*, notably *M. scopa* and *M. minutiflora*, but differs from the latter in its taller stems and much larger flower, and from *M. scopa*, often similar in stature, in the peltate blade of the much larger banner. Until the truly ripe fruit of *M. sarodes* is discovered, the affinities of the species will remain open to controversy, but its status as a species seems secure. All annual members of ser. *Unifoliolatae* differ from *M. sarodes* in the pectinate ciliolation of the calyx-ribs and a banner-blade open at the base.

Only a few plants of *M. sarodes* were seen at the type-locality, growing on the precipitous bank of a ravine, among blocks of volcanic rock in light shade of oaks, associated with *Calochortus hartwegii* Bth. and the rare annual *Dalea dipsacea*. At the time my attention was distracted by discovery of the latter, and I mistook *M. sarodes* for the common and weedy *M. scopa*. Possibly other collectors may have passed it by for the same reason.

B. Sectio Carroa (K. B. Presl) Barneby

Pod little or not compressed, subglobose to plumply pyriform, the style-base becoming lateral, the valves closely investing and adherent to the seed, the valves charged with scattered blister-glands arranged in no obvious pattern. Plant entirely glabrous. Shrubs and herbs, the latter perennial or annual. — Spp. 8, most diverse and numerous in s.-centr. Mexico.

Marina sect. **Carroa** (K. B. Presl) Barneby, stat. nov., based on *Carroa* K. B. Presl, Symb. Bot. **2**: 25, Pl. 71. 1858, pro gen., a substitute for *Trichopodium* K. B. Presl, Bot. Bemerk. 52. 1844; non *Trichopodium* Lindl., Bot. Reg. **18**: tab. 1543. 1832, here interpreted as an orthographic variant of (not an illegitimate substitute for) *Trichopus* Gaertn., hence a genuine obstacle to *Trichopodium* Presl. — Generitypus: *T. glandulosum* K. B. Presl = **Marina diffusa** (Moric.) Barneby. — *Parosela* subgen. *Trichopodium* (K. B. Presl) Rydb., N. Amer. F. **24**: 49. 1919, quoad typum, sed minori pro parte.

Parosela subgen. *Trichopodium* V. *Diffusae* Rydb., N. Amer. Fl. **24**: 57. 1919, max. pro parte. — Species typica: *P. diffusa* (Moric.) Rydb. = **Marina diffusa** (Moric.) Barneby.

Herbarium specimens of most marinas of the Carroa type are superficially very similar, and the taxonomy of the group could not have been clarified without study in the field. Many of the best specific characters are expressed in duration, stature, and general habit of growth, but most species, whether shrubby, herbaceous perennial, or monocarpic, are too large to fit into the standard plant press and the majority of specimens consist of partial inflorescences, not showing the stem-leaves, and nearly always unaccompanied by notes on root or stature. Identification ordinarily requires close scrutiny of the form and size of the banner, at the same time taking into consideration the presence or absence of prominent warty glands and the number and disposition of flowers on the raceme-axis. With experience it has been found that even fragmentary specimens have an individual facies, rarely misleading on close study.

Adoption for the section of the mame *Carroa* (honoring Giovanni Carro, physician, early advocate or faccination, prominent at Baden Baden in first half of XIX century) in place of *Trichopodium*, familiar from its use by Rydberg at subgeneric level under *Parosela*, requires some comment. Presl proposed *Carroa* as a substitute for his own *Trichopodium* (1844) in the belief (which I share) that it was a later homonym of *Trichopodium* Lindl. (1832). The latter, however, is the exact equivalent of *Trichopus* Gaertn. and if regarded as a new name for the latter, is illegitimate and therefore no obstacle to *Trichopodium* Presl. In the latter case, *Trichopodium* Presl is the correct name for *Marina*, having a nine year priority. If it is agreed, however, that *Trichopodium* of Lindley is merely an orthographic variant of *Trichopus*, it must be considered in consequence a real obstacle to *Trichopodium* Presl. If this view is held incorrect, I would propose conservation for *Marina* Liebm.

31. Marina nutans (Cavanilles) Barneby

(Plate XXIII)

Perennial herbs becoming suffruticose in age, (4) 7–15 (20) dm tall, entirely glabrous, the livid-castaneous, striate or angular-ribbed, usually densely tuberculate stems virgately erect and incurved-ascending, usually simple up to near the middle and thence paniculately branching, rarely branched from base upward, exceptionally

diffuse, but always arising from a tough, orange-yellow root, the foliage bicolored, the leaflets deep green above, pallid and minutely punctate beneath, lineolate both sides, their margins gland-crenulate; *leaf-spurs* 0.4–1 mm long; *stipules* narrowly triangular to subulate-attenuate, 0.5–2 (2.5) mm long, commonly fimbriolate at base; *intra-* and *post-petiolular glands* all prominent, slenderly subulate or prickle-shaped; *main cauline leaves* (2) 2.5–5 cm long, subsessile, with narrowly margined rachis (the flat ventral face 0.2–0.35, rarely 0.4 mm wide) and 8–20 (some at least 10) pairs of narrowly oblong or oblong-oblanceolate, mostly obtuse and bluntly gland-mucronulate, dorsally keeled leaflets (3) 3.5–7 (8.5) mm long, the rameal leaves progressively smaller upward, those opposed to peduncles with (3) 4–8 pairs of shorter leaflets; *peduncles* leaf-opposed and terminal to branchlets, 0.5–2.5 (3.5) cm long; *racemes* loose to moderately compact, the more vigorous ones mostly 7–35 (rarely to 50)-flowered, but those of some distal branchlets often only 5–10-flowered, the flowers early spreading-ascending, finally declined, the axis becoming (0.5) 1–5 cm long; *bracts* enfolding the very young buds, deciduous early from a decurrent spur, ovate-acuminate beyond the cuneate base, boat-shaped, submembranous, sparsely glandular, the margins fimbriolate; *pedicels* (1) 1.2–1.8 (2) mm long, charged with gland-grains (rarely transformed into fimbriolate bracteoles) above middle; *calyx* 3.4–4.3 (4.5) mm long, the shallowly pleated tube 1.8–2.4 (2.6) mm, the firmly membranous intervals charged with 1 row of 3–5 elliptic, sometimes irregularly confluent glands of inconspicuous brownish color, the prominent ribs purplish, the teeth unequal, the dorsal one longest, ovate- or lance-acuminate, acute, 1.4–2 (2.2) mm long, the ventral pair shortest and broadest, united through nearly half their length behind the banner, obtuse, all erose, minutely crenulate, or rarely fimbriolate around the margins; *petals* all pink- or magenta-purple or -violet, but the banner usually opening bicolored, whitish in the middle but rubescent, the tip and lobes usually purple, the keel usually gland-sprinkled, the wings rarely, the banner never so, the keel exceptionally gland-tipped, the inner petals perched between 1.8 and 3.8 (5) mm above hypanthium rim; *banner* (3.6) 4–5.2 mm long, the laterally winged claw (1.1) 1.4–2.1 (2.4) mm long, the deltate-cordate or obtusely 3-lobed, deeply emarginate blade recurved through 40–80°, (2.8) 3–4.3 mm long, (2.8) 3–4 (4.4) mm wide, the basal lobes joined across top of claw by a transverse wing enclosing a cornet and sometimes produced at the middle into a 2-dentate projection facing the blade; *wings* 5–6.2 mm long, the claw 0.3–0.6 mm, the obovate blade 4.6–5.6 mm long, 2.4–3 mm wide; *keel* (5.5) 5.9–7.7 mm long, the claws 0.7–1.6 mm, the oblong-obovate blades (5) 5.4–6.6 mm long, 3–3.8 mm wide; *androecium* 10-merous, (6.8) 7–9.5 (10.5) mm long, the longest filaments free for 1.5–2.8 mm, the anthers (0.45) 0.5–0.65 mm long; *pod* subglobose, nutlike, charged all over with many subcontiguous blister-glands, the whole surface appearing bullate; n = 10 (Spellenberg, 1973); 2n = 20 (Mosquin). Collections: 80 (xiv).

Brushy and thinly timbered hillsides in the oak and pine belts, occasionally descending into grassland, or pedregal, locally along streams down (rarely) to 300 m, abundant and characteristic of hill country at 1100–2550 (2790) m (± 3700–9300 ft) nearly throughout the Transverse Volcanic Belt from Nayarit to Puebla, and along Sierra Madre del Sur from Guerrero into s. and centr. Oaxaca, n. along Sierra Madre Occidental, both on the Pacific slope and around the edge of Meseta Central, to s.-w. Chihuahua (reaching near 28° N. on Río Mayo) and along Sierra Madre Oriental into s.-w. Tamaulipas (Sierra de Jaumave) and adjoining Nuevo León. — Flowering September to January, sporadically later. — *Representative*: CHIHUAHUA: *Gentry 1913* (ARIZ, F, UC), *22,766* (RENNER). SINALOA: *Gentry 6557* (ARIZ). DURANGO: *Palmer*

836 (C, F, NY, UC); *Gentry 6903* (F, NY). NUEVO LEÓN: *Meyer & Rogers 2712* (BR). TAMAULIPAS: *von Rozynski 195* (F, NY, UC). SAN LUIS POTOSÍ: *Ripley & Barneby 14,758* (CAS, DAO, MEXU, NY, US). NAYARIT: *Ripley & Barneby 14,048* (CAS, NY). ZACATECAS: *Gentry 8442* (MEXU, UC); *Feddema 2476* (MICH). JALISCO: *Pringle 1802* (BR, F, M, NY, UC, W); *Rzedowski 17,696* (ENCB); *McVaugh 13,264* (MEXU, MICH), *22,062* (MICH). GUANAJUATO: *Ripley & Barneby 13,359* (MEXU, NY, US). MICHOACÁN: *Hinton 15,576* (ARIZ, NY); *Arsène 5538* (L, NY, US); *Ripley & Barneby 14,846* (CAS, DAO, NY, US). MÉXICO: *Hinton 8654* (ARIZ, F, NY, W, Z); *Purpus 5650* (NY, F, UC); *Pringle 8916* (CAS, F, M, NY, TEX, UC, W, Z). HIDALGO: *Pringle 11,334* (ARIZ, F, OKLA, UC). PUEBLA: *Nicolas distrib. Arsène 5502* (NY). MORELOS: *Ripley & Barneby 14,537* (CAS, NY, US). GUERRERO: *Hinton 14,769* (ARIZ, NY, W). OAXACA: *Liebmann 4609* (UC); *Ripley & Barneby 14,639* (DAO, IA, MEXU, MICH, NY), *14,664* (CAS, F, GH, MEXU, NY, US).

Marina nutans (Cav.) Barneby, Phytologia **26**: 2. 1973, based on *Psoralea nutans* (nodding, of the flowers) Cav., Icones **3**: tab. 201. 1794. — "Habitat in Nova-Hispania. [Perennis]. Florebat in Regio horto Matritense mense Decembri 1793." — Holotypus, labelled "ex hort. Reg. Matrit. 1793.", MA (herb. Cav.)! — The cultivated specimen is mounted with a wild plant ticketed "De Nueva España. Neé iter," which may have accompanied seed collected on the Malaspina Expedition. — *Dalea nutans* (Cav.) Willd., Sp. Pl. **3**: 1339. 1801. *Parosela nutans* (Cav.) Rose, Contrib. U. S. Nat. Herb. **8**: 306. 1905.

Dalea pulcherrima (most beautiful) Sessé & Moc. ex G. Don, Gen. Hist. Dichl. Pl. **2**: 225. 1832. — "Native of Mexico....*D. violacea* Cervantes mss. (v. s. in herb. Lamb.)." — Holotypus not identified as such, possibly lost, unless it is the sheet at BM mentioned below; the sheet of this species at OXF, probably from Herb. Lambert. but not annotated by Don, is labelled "*Dalea purpurea sp. nov. de Mexico*" and presumably = *Herb. Sessé & Moc. 2664* (MA) which bears the same unpublished name. Presumed isotypi: *Herb. Sessé & Moc. 2676* (MA), labelled "*Dalea pulcherrima*", and a sheet labelled "*D. violacea*" at BM (ex herb. Shuttlew., distrib. Pavón)!

Parosela submontana (of low mountains) Rose, Contrib. U. S. Nat. Herb. **8**: 306. 1905. — "Collected by J. N. Rose near Plateado, Zacatecas, September 2, 1897 (no. 2744)." — Holotypus, US! isotypi, GH, NY! — *Dalea submontana* (Rose) Bullock, Kew Bull. **1939**: 198. 1939.

This is the showy, herbaceous or weakly suffrutescent marina that is commonest in southern Mexico's pine-oak belt, showy that is by comparison with the monocarpic *M. scopa* or the truly shrubby *M. diffusa* because the petals are less quickly shed, the normal raceme at full anthesis bearing several expanded flowers at a time. In the relatives mentioned, the flowers follow one another day by day, each shedding its petals before the next expands. Only *M. neglecta* has similarly well furnished racemes of open flowers, and this, found usually as a roadside weed below the oak-belt, is readily separated by the few (5–9) pairs of leaflets in main cauline leaves and, in the case of var. *neglecta*, the commoner form, by the ciliolate calyx-tube. In western Mexico, northward from Jalisco, and perhaps through much of Sierra Madre del Sur, *M. nutans* is nearly sympatric with *M. crenulata*, although probably always ecologically separated, the latter being adapted to more xeric habitats. These are somewhat alike in the detached raceme, but in the plant-body (see Plates XXI and XXIII) are so different that even without the characteristic pods they are separable without difficulty.

Over its very extensive range *M. nutans* varies in stature and in length and density of the raceme. A tall, virgately branched type up to 1–1.5 m tall is widespread in the Transverse Volcanic Belt; its raceme is usually loose but short, up to about 20-flowered, but the ultimate branchlets bear smaller racemes, often less than 10-flowered, the facies of the inflorescence altering with the passage of time. A more compact raceme is associated with a

more diffuse and less tall habit of growth, and distinguishes much of the material from around the edge of Meseta Central in Durango, Sinaloa, Guanajuato, and Tamaulipas. The typus of *M. submontana* was apparently a tall ecotype but has relatively many-flowered moderately dense racemes. In Oaxaca and perhaps Puebla a similarly tall plant produces from first to last only short, loose racemes of less than 10 flowers. One collection from México (*Pringle 8916*) is notable for its very long, many-flowered racemes (up to 50-flowered) combined with tall stems. As here defined, *M. nutans* seems to conceal within it a number of incipiently differentiated geographic races, but as the flower, except for very minor modifications, maintains an intact individuality, no taxonomic division of the species seems possible.

In Rydberg's monograph (1919) *M. nutans* appears under the name *Parosela submontana*, the epithet *nutans* being misapplied to the species here described as *M. scopa*. Specimens of these two marinas are (or can be) superficially similar. The width of the green wing bordering the leaf-stalk is usually but not always greater in *M. scopa*, and provides no more reliable a differential character than the number of flowers to the raceme. In the field the monopodial habit and annual root of *M. scopa* are easily observed and infallible marks of its identity, but these are seldom seen in the herbarium. In the herbarium the banner provides the best clue:

Blade of banner mostly 3–4.3 mm long, closed across the top of the claw to form a cornet, deeply emarginate but eglandular at apex; keel-blades mostly 5–6.6 mm long. *M. nutans.*

Blade of banner about 2–2.8 mm long, open at base, usually acute and always gland-mucronate at apex; keel-blades mostly 3.6–4.8 mm long. *M. scopa.*

32. Marina ghiesbreghtii Barneby

(Plate XXIII)

Slender glabrous shrubs up to 1 m tall (and probably taller), the livid, often glaucescent, impressed-glandular or sparsely and minutely low-tuberculate stems openly paniculate-branching distally, the racemes both leaf-opposed and terminal to branchlets, the foliage bicolored, the submembranous leaflets green above, pallid and punctate beneath, lineolate both sides, their margins gland-crenulate; *leaf-spurs* 0.2–0.5 mm long; *stipules* subulate-attenuate, 0.4–0.9 mm long, fimbriolate at base; *intra-* and *post-petiolular glands* all subulate, conspicuous; *main cauline leaves* sessile or subsessile, 1.2–2 cm long, with narrowly margined rachis (ventral face ± 0.2–0.25 mm wide) and 6–11 pairs of narrowly oblong or oblong-oblanceolate, bluntly gland-mucronulate leaflets 2–4 mm long, the rameal leaves shorter, those opposed to peduncles with 3–5 pairs of leaflets 1–3 mm long; *peduncles* very slender, 0.5–3.5 cm long; *racemes* loosely 10–40-flowered, the first of each main division of the panicle at least 20-flowered, the flowers ascending and spreading on flexuous pedicels, the axis 2.5–5.5 (7) cm long; *bracts* early deciduous from short, decurrent spurs, spatulate-cuneate, acute, ± 1 mm long, the submembranous body fimbriolate; *pedicels* 0.7–1.1 mm long, charged with gland-grains below apex; *calyx* 2.3–2.5 mm long, purplish-brown, the tube prominently ribbed but not or scarcely pleated, 1.3–1.5 mm long, charged in each interval with one row of 2–3 (4) orange or livid blister-glands, the teeth unequal, the dorsal one longest, ovate, acute, 0.9–1.1 mm long, the ventral pair shorter and broader, obtuse, all minutely gland-mucronulate and erose around the membranous margins; *petals* purple, but the banner opening white above the basal lobes, early rubescent, gland-tipped and often with a few small glands near middle of

blade, the inner petals perched between 1 and 2.3 mm above hypanthium rim, the keel gland-sprinkled; *banner* 2–3.3 mm long, the claw 1–1.3 mm, the cordately deltate or spade-shaped blade recurved through ± 45°, recessed at base into a cornet, 1.9–2.4 mm long, 1.8–2.2 mm wide; *wings* 2.5–4.1 mm long, the claw (often lateral) 0.2–0.3 mm, the broadly obovate blade 2.4–4 mm long, 1.4–2.1 mm wide; *keel* 3.9–4.9 mm long, the claws 0.6–0.7 mm, the obovate to broadly oblong-elliptic blades 3.3–4.3 mm long, 2.4–3.2 mm wide; *androecium* 10-merous, 4.7–6.4 mm long, the longer filaments free for 1.1–1.8 mm, the anthers 0.5–0.55 mm long; *pod* plumply obovoid, 1.7–2 mm long, 1.3–1.5 mm diam, crested ventrally above the pore, smoothly rounded dorsally, filled by the seed, the firm livid valves not hyaline at base, charged at least beyond the middle with many contiguous blister-glands up to 0.2–0.25 mm diam, the whole surface therefore bullate-pustular. — Collections: 3 (o).

Habitat not recorded, to be expected in oak woodland, flowering in late fall and winter, known only from Sierra Madre del Sur in Guerrero and Chiapas. — *Material*: GUERRERO: typus. CHIAPAS: sine loc., *Ghiesbreght 586* (K, NY); Río de Puerto Moneda, Sierra Nevada del Sur, *Purpus 10,360* (NY, UC).

Marina ghiesbreghtii (Auguste Boniface Ghiesbreght, 1810–1893) Barneby, sp. nov., inter affines fruticosas floribus parvulis, calyce ± 2.4 mm, carinae laminis 3.3–4.3 mm tantum longis insignis. — Frutices graciles metrales forsan altiores, glaberrimae; folia caulina 1.2–2 cm longa, rachi anguste marginato haud alato, foliolis 6–11-jugis, ramealia breviora, foliolis eorum pedunculo oppositorum 3–4-jugis; racemi laxi 10–40-flori, robustiores saltem 20-flori, axi fructifero 2.5–7 cm longo; flores iis *M. nutantis* similes nisi multo minores, vexilli lamina basi peltata 1.9-2.4 mm longa apicem versus glandula instructa; legumen sect. *Carroae* ultra medium dense pustuloso-bullatum. — GUERRERO. Montes de Oca: Vallecitos, nov 22, 1937, *George B. Hinton 11,586*. — Holotypus, NY; isotypi, MICH, RENNER, UC, US.

Hemsley (1880, p. 244) identified the first collection of this species, obtained somewhere in Chiapas by Ghiesbreght, as *Dalea nutans*, and the relationship in this direction is obviously a close one. The species has been found only in a relatively remote and little collected tract of Sierra Madre del Sur and is still too little known to permit prognosis about its future taxonomic status. The cited material differs abruptly from all the many variants of the common *M. nutans* in the very small flowers, but these do not differ essentially in structure. Field observation of its habitat, stature, and duration are required before any verdict can be reached.

33. MARINA DIFFUSA (Moricand) Barneby
(Plate XXIV)

Glabrous shrubs up to 1–2.5 m tall, sometimes precociously flowering as suffrutescent herbs, with 1–several stiff or flexuous and wandlike, livid-purple, usually glaucescent, ligneous main stems effusely and repeatedly branching distally into a broadly round-headed panicle of slender, finally capillary branchlets, these usually stramineous, the stems only sparsely, often obscurely impressed-glandular, not tuberculate, the foliage bicolored, the leaflets green above, pallid and minutely or subobsoletely punctate beneath, lineolate both sides, the margins gland-crenulate; *leaf-spurs* 0.2–0.8 mm long; *stipules* membranous, ovate- or subulate-attenuate, 0.3–1.4 mm long, often fimbriolate at base; *intra-* and *post-petiolular glands* small but prominent, subulate or prickle-shaped; *main cauline leaves* (drought-deciduous, often absent from flowering

specimens) 1.5–3.5 (4) cm long, with narrowly winged rachis (ventral face 0.25–0.35 mm wide) and 6–12 (17) pairs of oblong or oblong-oblanceolate, flat, dorsally carinate leaflets 3–6.5 (7.5) mm long, the leaves opposed to and between peduncles much smaller, 1–9 mm long, 1–7-foliolate, the leaflets mostly obovate to broadly oblanceolate and entire, 0.7–5 mm long; *peduncles* very slender or capillary, leaf-opposed and terminal to all ultimate branchlets, 0.5–3 (4) cm long; *racemes* very loosely or remotely 1–25-flowered, the lowest of each primary division of the panicle 5–25-flowered (some always over 5-flowered) the terminal ones mostly 1–6-flowered, the axis becoming (0) 1–45 mm long; *bracts* enclosing the very young buds, early thrown off, obovate-cuneate, submembranous, gland-denticulate at apex, up to 1 mm long; *pedicels* (0.6) 0.8–1.5 mm long, charged near apex with 2 gland-grains; *calyx* 2.5–3.6 mm long, prominently ribbed but not pleated, the tube (1.5) 1.8–2.2 mm long, its membranous intervals charged with 1 row of (2) 3–5, distinct or irregularly confluent, orange blister-glands, the teeth ± unequal, the dorsal one longest, ovate-triangular, usually acute, 0.7–1.6 mm long, the ventral pair shortest, nearly half-circular, obtuse, 0.4–0.9 mm long, all imbricated at base, the margins pallidly membranous, erose or minutely fimbriolate, charged at apex and often laterally with 1–3 minute orange glands; *petals* ± bicolored, the blade of banner whitish beyond the purple-tipped lobes, the white area sometimes boldly striped, rubescent in age, the inner ones rose- or magenta-purple or deep maroon-violet, perched 1.4–3 mm above hypanthium rim, their blades sparsely gland-sprinkled; *banner* 2.5–3.5 mm long, the ± laterally winged claw thickened upward, 0.8–2.1 mm, the blade abruptly recurved through nearly 90°, ovate-deltate, emarginate, closed across the top of claw to form a recessed cornet, the apex sometimes gland-tipped; *wings* 3.5–4.7 mm long, the claw 0.2–0.4 mm, the obovate blade 3.5–4.6 mm long, 2.2–3 mm wide; *keel* 4.4-5.9 mm long, the claws 0.7–1.2 mm, the broadly obovate blades 4.2–5.3 mm long, 2.8–3.5 mm wide; *androecium* 10-merous, (5.5) 6–8 mm long, the longest filaments free for 1.5–2.1 mm, the connective gland-tipped, the pale bluish anthers 0.5–0.7 mm long; *pod* plumply obovoid, 2.7–2.9 mm long, 2–2.5 mm diam, little compressed, the short style-base becoming lateral or latero-subterminal, the ventral suture strongly keeled above the pore, the dorsal suture smoothly rounded and not carinate, the valves contracted proximally into a subhyaline, obconic base ± 0.3 mm long, thence firm, closely investing the seed, green or purplish becoming brown, charged with many small, low-protuberant glands ± 0.2 mm diam, these arranged in no obvious pattern; *seed* ± 2.1–2.5 mm long.

While *M. diffusa* is related to *M. nutans* and in herbaria often confused with it, it appears in the field as an entirely different plant with a characteristic individual facies. The mature plant, veteran of several seasons' growth, consists of two or more erect ligneous trunks up to 1–1.5 cm diameter, each of which gives rise, during the rainy summer months, to a cluster of firmly pliant, purple-glaucescent secondary stems reaching at least a meter high and densely clothed with long leaves composed of many leaflets. As the dry season approaches, the foliage begins to fall from these secondary stems which go out in turn into an airy panicle of repeatedly forking, very slender and ultimately threadlike branchlets subtended by abruptly simpler leaves mostly much shorter than the internodes, and a multitude of laxly few-flowered racemes. At full anthesis and in fruit the plant forms a broad-headed tangle of capillary branchlets, the whole bending and swaying gracefully in the least current of air, and elevated on an apparently almost leafless framework. As already mentioned under *M. nutans*, the flowers of *M. diffusa* are of fleeting duration, the petals falling a few hours after expanding, so that one rarely finds two open at once on the same

raceme. The shrubs of *M. diffusa* are usually colonial, sometimes forming a long line along fences of cultivated land, sometimes small thickets, or more scattered populations mixed with other shrubs as an understory in oak woods.

Over much of its range *M. diffusa* varies little, some plants from points as far apart as Sonora and Guerrero being virtually indistinguishable. Only in a small tract of country near the middle of its area of dispersal has it developed a marked variant, here described as var. *radiolata*, which replaces var. *diffusa* locally in the canyons of the Río Grande system in s. Zacatecas, eastern Nayarit, and adjoining Jalisco, and in the basin of Lago Magdalena in the latter state. The populations of *M. diffusa* in Sierra Madre del Sur and in Guatemala are only poorly collected and indifferently understood; they may conceal, as mentioned further under var. *diffusa*, taxonomically separable entities.

Key to the Varieties of *Marina diffusa*

1. Blade of banner white distally, inconspicuously veined, nearly always charged with a subapical gland; *inner petals* magenta or rose-purple; leaves of the very finely and repeatedly ramified ("gypsophiloid") panicle mostly 1–4.5 mm long, the rachis 0.1–1 mm long, the leaflets 1–5, 0.8–3 mm long; *racemes* 1–10-flowered, the first of each primary division of the panicle ± 6–10-flowered, the terminal and distal ones (1) 2–5-flowered; range of the species except where replaced by the next. 33a. var. *diffusa*.
1. Blade of banner conspicuously striped with broad, stippled, dull purple rays, commonly eglandular at apex; *inner petals* wine-red or maroon-purple; *leaves* of the less finely ramified panicle 3.5–9 mm long, the rachis 1–4.5 mm long, the leaflets 3–7, 1–5 mm long; *racemes* (3) 6–25-flowered, the first of each primary division of the panicle at least 9-flowered, the distal ones mostly 5- or more-flowered; n.-centr. Jalisco and adjoining Nayarit and s. Zacatecas. 33b. var. *radiolata*.

33a. MARINA DIFFUSA (Moricand) Barneby var. DIFFUSA
(Plate XXIV)

Characters as given in key; n = 10 (Spellenberg). — Collections: 46 (viii).

Brushy hillsides, hedgerows, and openings in oak woodlands, 200–1800 m (± 650–6000 ft), widespread and locally common along the w. slope of Sierra Madre Occidental from Nayarit to Río Bavispe in n. Sonora, and extreme s. Arizona (Kearney & Peebles, 1960, p. 436), e. along the s. slope of the Transverse Volcanic Belt to s. México and adjoining Morelos and Guerrero (but partly replaced in this segment of its range by var. *radiolata*, q. v.); also, perhaps disjunctly, in Sierra Madre del Sur from s.-centr. Guerrero to s. Oaxaca; one station in Guatemala (dept. Guatemala), but not yet reported from Chiapas. — Flowering September to February, rarely from mid-August n.-ward. — *Representative*; MEXICO. SONORA: *Gentry 480 M* (MICH), *1369* (ARIZ, F, MEXU, UC, W); *S. S. White 3707* (ARIZ, MICH). CHIHUAHUA: *LeSueur 1216* (UC). SINALOA: *Gentry 5207* (ARIZ, NY); *Ortega 1142* (MEXU). DURANGO: *Gentry 5337* (ARIZ, NY). NAYARIT: *Jones 23,062* (NY, POM, UC); *Gentry et al. 19,516* (US). JALISCO: *McVaugh & Koelz 386* (MICH); *Spellenberg & Dunford 2950* (NY); *Purpus 512* (UC); *Ripley & Barneby 13,442* (MEXU, NY, US). MICHOA-

CÁN: *McVaugh 22,630* (ENCB, MICH); *King & Soderstrom 4599* (MEXU, NY, UC, US); *Ripley & Barneby 14,068, 14,802, 14,825* (NY). MÉXICO: *Hinton 2267* (F, MEXU, NY, Z); *Rzedowski 18,237* (ENCB); *Ripley & Barneby 13,748* (CAS, GH, K, MEXU, MICH, NY, US). COLIMA: *Palmer 1189* (G, NY). GUERRERO: *Hinton 11,255* (ARIZ, W); *Palmer 507* (F, NY, UC); *Ripley & Barneby 13,719* (CAS, NY, US). MORELOS: *Ripley & Barneby 14,543* (CAS, IA, NY). OAXACA: typus of *Dalea ramosissima*. GUATEMALA: *J. Donnell Smith 2315* (M, MICH, NY).

Marina diffusa (Moric.) Barneby, comb. nov., based on *Dalea diffusa* (diffuse, of the flowering panicle) Moric., Mém. Soc. Genève **6**: 536, Tab. VI. 1833. — "Hab. in nova Hispania (communiquée par M. Pavon)." — Holotypus, labelled "Nouvelle Espagne, M. Pavon, 1827", G! presumed isotypi, *Sessé & Mociño Herb. 2655*, labelled "*Dalea diffusa* Nobis", F, MA! — *Trichopodium diffusum* (Moric.) Presl, Bot. Bemerk. 53. 1844. *Carroa diffusa* (Moric.) Presl, Symb. Bot. 25. 1858. *Parosela diffusa* (Moric.) Rose, Contrib. U. S. Nat. Herb. **8**: 305. 1905.

Dalea gracilis (slender) Hook. & Arn., Bot. Beechey 286. 1836. — "Tepic", or (op. cit. 416. 1840) "San Blas to Tepic." — Holotypus, labelled "Tepic, *Barclay*", K (herb. Hook.)! (Non *Dalea gracilis* Kunth).

Dalea ramosissima (much branched) Mart. & Gal., Bull. Acad. Brux. **10**[2]: 41. 1843. — '...dans... la cordillère qui longe l'Océan pacifique, dans le département d'Oaxaca, près de Juquila et de Sola, de 4 à 5,000 pieds... [*Galeotti*] No. 3162." — Holotypus, labelled "Sola, Juquila, Yolotepèque...*No. 3162*", BR (herb. Martens.)! isotypus, labelled "Sola...*No. 3162*", BR (Herb. Galeott.)!

Trichopodium glandulosum (glandular, of the calyx) Presl, Bot. Bemerk. 52. 1844. — "Habitat in Mexico." No collector given. — No typus seen; to be sought at PR, probably in herb. Haenke. — *Carroa glandulosa* (Presl) Presl, Symb. Bot. 25, tab. 71. 1858.

In the key to the varieties the normal flower-number in primary racemes of var. *diffusa* is given as 6–10, correct for the material seen from western and south-central Mexico. In Sierra Madre del Sur from southern Michoacán (*Langlassé 753*, MICH) eastward, the primary racemes are often reduced to four or five flowers, quickly succeeded by racemes of only three, two, or one. The one known collection from Guatemala (Aceituna, dept. Guatemala, cited above) is like the latter, except that the individual flower is very small, with calyx ± 2.5 mm, androecium only ± 5.5 mm long. These populations, known from rather incomplete material, require investigation in the field; and on revision will need to be compared with the original *Trichopodium glandulosum* of Presl. The protologue of *T. glandulosum* describes the pedicels as solitary, axillary, and 2–4 lines (= 4–8 mm) long; the pedicels, however, as shown in the plate published subsequently under the name *Carroa glandulosa*, are in reality 1-flowered peduncles. No example of such extreme reduction of all racemes has been collected since, and the exact identity of *T. glandulosum* cannot be determined at the present time. That it is very closely related to *Dalea diffusa* Moric. was recognized from the first, and I can find nothing in the description that would exclude it from that species, sensu lato.

In central Mexico var. *diffusa* is one of several marinas known as *escoba* or *escobilla*, the tough, pliant twigs being tied in fasces and used as brooms. Diguet records the usage *limoncillo* in Jalisco, a word applied in Sonora to the agreeably fragrant *Dalea lumholtzii*. Ortega and Mexia independently record *cadillo* in Sinaloa, and Gentry heard *popotillo* in Sonora, another name shared by a sympatric *Dalea*. The number of vernacular names testifies to the conspicuous and idiosyncratic appearance of the plants.

See also comment on *Psoralea laevigata* S. & M. in Appendix I.

33b. MARINA DIFFUSA (Moricand) Barneby var. RADIOLATA Barneby (Plate XXIV)

Characters as given in key. — Collections: 17 (i).

Brushy hillsides and banks of streams, 1050–1450 m (± 3500–4800 ft), locally plentiful but of restricted range in canyons leading to Río Ameca and Río Grande de Santiago in n.-centr. Jalisco and adjoining Nayarit and Zacatecas, s. in Jalisco to the basins of Lago Magdalena and Lago Atotonilco, w. to the headwaters of Río Guachinango. — Flowering late August to March. — *Representative*: ZACATECAS. Moyahua de Estrado: 10–12 mi. s. of Moyahua, *Gentry 18,299* (RENNER, US). NAYARIT. Ixtlán del Río: La Atarjea, *Mexia 878* (F, MICH, NY, UC); e. of Ixtlán, *Ripley & Barneby 14,052* (CAS, NY, US). JALISCO. Guadalajara; Guadalajara, *Pringle 1731* (F, L, M, UC); La Barranca, *Jones in 1930* (NY, UC). Villa Corona: road to Cocula, *Rzedowski 14,526* (ENCB). Magdalena: w. of La Quemada, *Pennell 19,919* (GH, NY). Etzatlán: Etzatlán, *Rose & Painter 7350* (NY, US), *Gentry 5348* (ARIZ). Mezquitic (?): road from San Juan Capistrano (Zac.), *Rose 2318* (NY). Guachinango: Zluachinango, *E. W. Nelson 4007* (NY); Mascota: C. de la Barranca, *González & Palafox 69* (MICH).

Marina diffusa (Moric.) Barneby var. **radiolata** (rayed, of the banner) Barneby, var. nov., a var. *diffusa* panicula minus intricatim ramosa, foliis ultimis majoribus, foliolis praesertim 2–3-jugis, racemis inferioribus 9–25-floris terminalibus saltem 5-floris, vexillique lamina radiatim livido-striata eglandulosa separanda. — NAYARIT. Ixtlán del Río: La Barranca [= Plan de Barranca], feb 21, 1927, *M. E. Jones*. — Holotypus, NY.

While the panicle of var. *radiolata* is less elaborately ramified than that of var. *diffusa* the guise of the growing plant is hardly different, except for the deep maroon-purple of the petals, which appear almost black in strong sunlight. The range of var. *radiolata* forms an enclave within the extensive area occupied by its species, an enclave from which the type is nearly absent. Typical var. *diffusa* occurs abundantly along the hills around the north-west shore of Lago Chapala and has been collected in the canyon of one affluent of the Río Grande northeast of Guadalajara (Ixtlahuacán de los Membrillos, *Detling 8785*, MICH), but these populations show no sign of intergradation to var. *radiolata*.

34. MARINA GRACILLIMA (Watson) Barneby (Plate XXV)

Prostrate, perennial, wholly glabrous herbs, with several or many tough but slender, livid-castaneous, minutely low-tuberculate stems up to 5–8 dm long radiating from the knotty crown of a heavy, orange-red root, delicately but densely leafy throughout, the main axis loosely but narrowly paniculate distally but also giving rise at nearly all primary axils to subfiliform branchlets, the foliage green, the leaflets a trifle paler beneath, epunctate but sparsely gland-crenulate; *leaf-spurs* up to 0.5 mm long; *stipules* narrowly subulate-attenuate or the upper ones subsetiform, 0.4–1 mm long, fimbriolate at base; *intrapetiolular gland* 1, conic-prickle-shaped; *post-petiolular glands* 2, similar; *main cauline leaves* (drought-deciduous) 1–1.8 cm long, subsessile, with very narrowly margined rachis and 6–9 pairs of linear-oblong, -elliptic, or -oblanceolate, gland-mucronulate, flat leaflets 2–3.5 mm long, the terminal leaflet shortly

stalked beyond but no longer than the last pair, the leaves of branchlets mostly shorter, with (3) 4–6 pairs of similar leaflets only 0.7–2 mm long; *peduncles* capillary, ± 1.5–2.5 cm long; *racemes* very shortly or umbellately 2–7-flowered, the axis mostly 1–3 mm long (rarely a solitary flower well below the rest); *bracts* early deciduous, ovate, short-acuminate, brown, minutely fimbriolate on margins; *pedicels* filiform, 0.6–0.8 mm long, charged at apex with 2 minute grainlike glands; *calyx* 2.2–2.6 mm long, the prominently ribbed but scarcely pleated tube 1.4–1.6 mm long, the orifice symmetric except for the shallow sinus between the 2 ventral teeth, the rather firm intervals charged with one row of 3–5 elliptic glands, the teeth triangular-ovate, the dorsal one slightly the longest, 0.8–1.1 mm long, the ventral pair broadest and shortest, all plane, green except for the pallid, submembranous, minutely crenulate margin, minutely gland-mucronulate; *petals* opening bicolored, the banner whitish except for purple-tipped basal lobes, the rest vivid magenta-purple, all coarsely veined, the banner and keel sparsely gland-sprinkled, the inner petals elevated 1.2–1.8 mm above the hypanthium rim; *banner* 2.7–3.2 mm long, the incurved claw ± 1.2 mm, the blade sharply recurved through ± 90°, ovate-cordate, obtuse or retuse, 2.2–2.5 mm long, 2–2.3 mm wide, recessed at base into a cornet; *wings* 4.2–4.5 mm long, the claw ± 0.4 mm, the obovate blade 3.9–4.3 mm long, 2.3–2.7 mm wide; *keel* 4.5–4.8 mm long, the claws 0.5–0.8 mm, the blades 3.9–4.3 mm long, 2.5–2.9 mm wide; *androecium* (9) 10-merous, 5–6 mm long, the longest filament free for 1.5–1.9 mm, the bluish, gland-tipped anthers 0.5–0.6 mm long; *pod* plumply obovoid, moderately compressed, the style-base lateral, the ventral keel prominent, the dorsal one obscure, the valves (not seen fully ripe) firm, distended over the seed, charged on each side with ± 6–10 glands arranged in no apparent pattern; *seed* slightly over 2 mm long. — Collections: 7 (o).

Stony places on grassy plains and on canyon-benches, ± 1500–1600 m (5000–5300 ft), very local, known only from the plains immediately surrounding Guadalajara, Jalisco and the nearby canyons and barrancas leading to Río Grande de Santiago. — Flowering September to November. — *Material*: JALISCO: Guadalajara, *Pringle 2462* (BR, F, M, MEXU, MICH, NY, UC, W, Z), *Bárcena 56* (MEXU), *Lemmon 23* (UC), *Pringle 11,418* (F, L, MEXU). Ciudad Granja just w. of Guadalajara, *Soderstrom 636* (US). Río Blanco, *Rose & Painter 2462* (F, NY, US). La Venta, *Lemmon 261* (UC).

Marina gracillima (Wats.) Barneby, comb. nov., based on *Dalea gracillima* Wats. Proc. Amer. Acad. **22**: 404. 1887. — "Guadalajara; September. (461)." — Holotypus, collected in 1886 by Edward Palmer, GH! isotypi, NY (2 sheets), US! — *Parosela gracillima* (Wats.) Rose, Contrib. U. S. Nat. Herb. **8**: 305. 1905.

Pending discovery of the truly ripe fruit, the close relationships of *M. gracillima* within its genus must remain doubtful to some degree. The pod shown in Plate XXV, from *Pringle 2462*, has reached full size; it was, when dry, strongly compressed laterally, but regained its plump, nutlike form when soaked. The apparent lack of a prominent sutural prow around the leading edge, and the indefinite gland-pattern of the valves suggest more direct kinship with *M. diffusa* of sect. *Carroa* than with any glabrous species of sect. *Marina*, such as *M. crenulata* and its allies. However this may be, there can be no question of the specific status of *M. gracillima*, the only glabrous *Marina* with prostrate, herbaceous main stems, relatively few (up to 9 pairs) of very small leaflets, and subumbellate racemes of only two to seven, often no more than five flowers. The exceptionally delicate and intricate foliage and the multitude of fine secondary and tertiary branchlets going out into a threadlike peduncle contribute to an immediately recognized facies.

35. MARINA MINUTIFLORA (Rose) Barneby
(Plate XXVI)

Slender, erect, obligately annual herbs from a slender, orange taproot, glabrous throughout, 1–5 (6) dm tall, effusely and repeatedly branching upward to form broad-headed or umbraculiform plants, the subcapillary terminal branchlets all floriferous, the main stems green, purple, or stramineous, minutely and distantly microtuberculate, the foliage bicolored, the membranous leaflets bright green above, pallid and minutely punctate beneath, lineolate both sides, the margins gland-crenulate; *leaf-spurs* almost 0; *stipules* submembranous, subulate-attenuate or -caudate, 0.5–1.5 mm long, fimbriolate at base; *intrapetiolular gland* spiculiform; *post-petiolular glands* prominent, conic or prickle-shaped; *main cauline leaves* 1.5–3 (3.5), exceptionally up to 7 cm long, shortly petioled, with mostly 8–13 (rarely fewer) pairs of oblong, oblong-oblanceolate, or narrowly obovate, obtuse or commonly openly retuse, bluntly gland-mucronate, flat leaflets 3–9 mm long, the rameal leaves shorter, with mostly 3–7 pairs of smaller leaflets; *peduncles* both leaf-opposed and terminal to branchlets, (1) 3–20 mm long; *racemes* very loosely or remotely (1) 2–6 (9)-flowered, the axis becoming (0) 3–12 (20) mm long; *bracts* early caducous from small decurrent spurs, spatulate or flabellate, 0.8–1.1 mm long, marginally fimbriolate; *pedicels* filiform, up to 1 mm long, 2-glandular at apex; *calyx* 2.1–2.7 (3) mm long, the shallowly obconic-campanulate tube 1.3–1.6 mm, not pleated, the ribs slender but prominent, the flat intervals charged with 3–6 small, uniseriate, golden glands, the teeth subequal, the dorsal one ovate-deltate, 0.9–1.4 mm long, the ventral pair slightly shorter and broader, united nearly half their length behind the banner; *petals* bicolored, the blade of banner opening whitish (often with purple basal lobes) early rubescent, eglandular, the inner petals vivid magenta-purple, also eglandular, perched 1.1–1.5 mm above hypanthium rim; *banner* 1.8–2.4 mm long, the claw 0.7–1.2 mm, the subcircular, entire or shallowly emarginate blade 1–1.5 mm long and about as wide, united across the top of claw to form a shallow cornet; *wings* 2.3–2.7 mm long, the claw 0.1–0.3 mm, the oblong-obovate blade 2–2.7 mm long, 1.3–2.4 mm wide; *keel* 2.2–3.5 mm long, the claws 0.4–0.8 mm, the broadly obovate blades 1.8–3.2 mm long, 1.3–2.4 mm wide; *androecium* 10-merous, 3.3–4.2 (5.2) mm long, the longer filaments free for ± 0.7 mm, the connective gland-tipped, the bluish anthers 0.25–0.35 mm long; *pod* 1.7–2 mm long, subglobose beyond the short, inversely conic base, slightly compressed, nutlike, crested ventrally above the pore, the style-base lateral, neither keeled dorsally nor prowed across the top, the valves firm distally, charged on each face with ± 20–30 small, firm subcontiguous glands up to 0.2–0.4 mm diam. — Collections: 11 (ix).

Brushy and grassy hillsides, commonly in shade of shrubs, apparently always on limestone, local but forming dense, colonial populations, about the e. edge of Balsas Depression in Morelos, Puebla, and adjoining Guerrero, in Puebla extending e. just into the upper margin of the Tehuacán desert; somewhat disjunct in s.-w. Oaxaca. — Flowering October to January. — *Material*: MORELOS (mpos. Cuernavaca, Yautepec, and Ayala); *Holway 5306* (NY, p. p.); *Ripley & Barneby 13,701* (CAS, MEXU, MICH, NY, US); *Ripley 14,905* (CAS, DAO, GH, MEXU, MICH, NY, US). PUEBLA (mpos. Izúcar de Matamoros, Acatlán, and Tehuacán): *Ripley & Barneby 13,692, 13,697, 14,571* (all NY), *13,676* (CAS, K, NY, US), *14,721* (CAS, MEXU, NY, US). OAXACA (mpo. Sola de Vega); *Ripley & Barneby 14,649* (CAS, MEXU, NY, US).

Marina minutiflora (Rose) Barneby, comb. nov., based on *Parosela minutiflora* (tiny-flowered) Rose, Contrib. U. S. Nat. Herb. **8**: 306. 1905. — "Collected by Mr. G. C. Pringle near Yautepec, Morelos, 1902 (no. 8721)." — Holotypus, US! isotypi, GH, NY, OKLA, TEX! — *Dalea minutiflora* (Rose) Bullock, Kew Bull. **1939**: 197. 1939.

Other than *M. scopa*, this species and the closely related *M. stilligera* are the only fully glabrous, annual members of the genus. They differ collectively from *M. scopa* in their small stature (1–5, rarely 6 dm, not 5–15 dm tall), their small flowers (calyx 2–3, not 3–4 mm long), and in the peltate blade of the banner which is recessed above the top of the claw into a little conic pit. Both species are notable for the extreme delicacy of all their parts.

In general aspect *M. minutiflora* and *M. stilligera* are similar and the more important differential characters require close observation. In *M. minutiflora* the blade of the banner is suborbicular in outline, only shallowly emarginate, and glandless (rarely a minute remnant of a subapical gland) and the pod is charged all over with small, firm-skinned blister-glands which do not break under pressure and are crowded together to present a continuously bullate surface. In *M. stilligera* the blade of the banner is ovate or spade-shaped, deeply retuse at the apex and charged with one large subapical gland and several smaller ones near the middle, while the pod is charged with fewer and larger, mutually distant, fragile glands which burst under pressure and stain drying papers with orange blots. Flowers and pods of these two types are, so far as known, neatly correlated ecologically, *M. minutiflora* being strongly and apparently obligately calciphile, whereas *M. stilligera* has been found only on volcanic bedrock, commonly in pedregal. Strong differential tendencies, but not quite exclusive, are also noted in the foliage and raceme, the main cauline leaves of *M. minutiflora* having on the average more numerous (8–13 not 6–9) pairs of leaflets but the racemes fewer (mostly 2–6 not 4–12) flowers less crowded along the axis. The ranges of *M. minutiflora* and *M. stilligera* overlap only in Morelos, where recent lava-flows overlying and interfingering with limestone bedrock permit the two species to occur in close proximity without actually mingling. It appears that the calcifuge *M. stilligera* tolerates somewhat higher rainfall and elevations than its relative.

36. Marina stilligera Barneby
(Plate XXVI)

Closely resembling the preceding in habit and stature; *main cauline leaves* 1.5–3 (3.5) cm long, the narrowly margined rachis 0.25–0.35 mm wide ventrally, the leaflets (4) 5–8 (9) pairs, 3–7.5 mm long, those of rameal leaves mostly 3–4 pairs and smaller; *peduncles* filiform, (1) 3–8 mm long; *racemes* loosely or remotely (3) 5–13-flowered, the axis 3–12 mm long; *calyx* 2.1–2.6 mm long, the tube 1.4–1.8 mm, the dorsal tooth 0.7–1 mm long; *banner* 2–2.4 mm long, the blade 1.5–1.8 mm long, gland-sprinkled in the eye and charged near the retuse apex with a large subapical gland; *keel* ± 2.5 mm long, the blade ± 2.4 mm long, 1.6 mm wide; *pod* in form and size like that of *M. minutiflora* but the valves charged on each face with ± 6–9 fragile blister-glands well separated from each other and up to 0.2–0.4 mm diam, discharging when bruised an orange oil. — Collections: 10 (vii).

Brushy flats and hillsides, often forming colonies in the light shade of shrubs, nearly always on volcanic bedrock, commonly on pedregal, 800–2100 m (2700–7000 ft), around and near the n. edge of the Balsas Depression in Morelos, s.-e. México, adjoining Guerrero, and Michoacán. — *Material*: Michoacán. Uruapan: s. of Uruapan, *Ripley & Barneby 14,112* (NY); Jacona: cf. typus; Tiquicheo: road to Huetamo, *Moore et al. 5678* (BH); Tuzantla: s. of Parícuaro, *Rzedowski 27,997* (ENCB). México. — : Bejucos, *Hinton 2541* (F, MEXU, NY); Valle de Bravo: Valle de Bravo to Color-

ines, *Ripley & Barneby 14,876* (NY). Coatepec Harinas: Coatepec, *Ripley & Barneby 13,760* (NY). MORELOS. Tepoztlán: e. of Ocotepec, *Ripley & Barneby 14,560* (CAS, IA, MICH, NY, US); Tepoztlán, *Ripley & Barneby 14,550* (NY). GUERRERO. Taxco: near Taxco, *Ripley & Barneby 13,719* (CAS, MEXU, NY, US).

Marina stilligera (bearing drops, of the large, fragile oil-glands on the pod) Barneby, sp. nov., *M. minutiflorae* proxime affinis sed vexillo profunde retuso sub apice necnon in media lamina glandulifero et praesertim legumine glandulis majusculis aurantiacis paucis inter se remotis adsperso absimilis. Folia majora caulina saepissime 13–19-foliolata et racemi subcompacte 4–12-flori, sed notulae haecce inconstantes. — MICHOACÁN. Mpo. de Jacona: 7 miles s.-w. of Zamora, 1680 m (5600 ft), Nov 3, 1963, *Ripley & Barneby 13,434*. — Holotypus, NY; isotypi, CAS, K, MEXU, MICH, US.

The close relationship of this species to *M. minutiflora* is discussed under the preceding. While prevailingly calcifuge, *M. stilligera* may possibly occur on limestone near Taxco, Guerrero; elsewhere it has been collected only on volcanics of recent origin.

37. MARINA GRAMMADENIA Barneby

(Plate XXVII)

Shrubs up to 2 (2.5) m tall, wholly glabrous, the livid, prominently microtuberculate stems openly paniculate distally, the foliage bicolored, the leaflets bright green above, pallid and minutely gland-punctate beneath, their margins gland-crenulate; *leaf-spurs* 0.2–0.6 mm long; *intra-petiolular gland* 1; *post-petiolular glands* prominent, subulate or acicular; *main cauline leaves* 2–5.5 cm long, shortly petioled, with narrowly green-margined rachis and 5–10 pairs of flat, oblong, obtuse or subtruncate, obtusely gland-mucronate, dorsally keeled leaflets 5–11 mm long, the terminal one stalked beyond but not much larger than the last pair, the uppermost leaves smaller, with fewer (± 2–6 pairs) of shorter leaflets; *peduncles* numerous, mostly terminal to short, slender, lateral and subterminal branchlets, 2–15 mm long; *racemes* shortly but loosely 2–6-flowered, the flowers spreading and declined from flexuous pedicels 1.4–1.7 (2) mm long, the zigzag axis becoming 2–6.5 mm long; *calyx* 3.5–4.2 mm long, the tube 1.9–2.5 mm long, little pleated but 5-carinate by the slender ribs, the thin but firm intervals charged with a confluent row of glands forming a continuous, linear (rarely interrupted) band produced beyond the sinuses of the teeth, the ovate-deltate teeth of nearly equal length, the dorsal one 1.5–1.8 mm long, the ventral pair united ± half their length behind the banner, the lateral ones overlapping by their subcordate bases, their margins minutely membranous and obscurely crenulate; *petals* except for pale tip of banner all vivid magenta-purple, in the lower third pale (when dry yellowish), the keel and banner sparsely gland-sprinkled, the inner petals elevated 2.5–4.8 mm above the hypanthium; *banner* 4.5– 6.3 mm long, the claw 1.4–2 mm, the deltate-suborbicular, emarginate blade recurved through ± 45°, 3.6–5 mm long, 4–5.6 mm wide; *wings* 4.3–5.5 mm long, the claw ± 0.3 mm, the oblong-obovate blade 4.3–5.5 mm long, 2.8–3.4 mm wide; *keel* 4.8–7.3 mm long, the claws 0.7–1.1 mm, the blades 4.8–6.3 mm long, 3.2–4.1 mm wide; *androecium* 10-merous, 8–11.5 mm long, the longest filament free for 2–2.5 mm, the connective gland-tipped, the bluish anthers 0.75–0.9 mm long; *pod* broadly obovoid, 2.7–3 mm long, 2.1–2.6 mm diam, subcompressed but not strongly flattened laterally, neither carinate along the dorsal side nor prowed across the top, the ventral suture carinate above the pore, the style-base lateral, up to 0.3 mm long, the valves firm, charged all over the distal ⅔ with large blister-glands. — Collections: 7 (o).

Wooded or brushy slopes in the oak-belt, sometimes on banks or sand-bars of streams, 1500–2500 m (± 5000–8330 ft), seldom collected and apparently rare, known from scattered stations in s. Michoacán, s.-e. and w. Jalisco, and disjunctly from Sierra Madre Occidental in n.-w. Durango. — Flowering November to February. — *Material*: DURANGO. Topia: Siánori, *Ortega 5289* (US). JALISCO. San Sebastián: Segundo Arroyo, *Mexia 1550* (F, MICH, NY, UC); Mascota: cf. typus; Talpa de Allende: Arroyo Hondo, *González 612* (MICH); Sierra del Cuale, *McVaugh 14,323* (MICH); Tecalitlán: Sierra del Halo, *McVaugh & Koelz 1173* (MICH). MICHOACÁN. Aguililla: 15 km s. of Asserradero Dos Aguas, *McVaugh 22,761* (ENCB, MICH).

Marina grammadenia (with lineate glands, of the calyx) Barneby, sp. nov., quoad habitum fruticosum elatum *M. diffusae*, quoad vexilli laminam basi apertam nec in puteolum concretam *M. scopae* similis, ab ea vexilli subdimidio majoris forma, ab hac semper monocarpica atque monopodiali caulibus fruticosis pluries fertilibus cito separanda. — Racemi pauci (2–6)-flori axis abrupte flexuosus, calyx glandulis in lineolam confluentibus pulchre 10-notatus, necnon vexillum magnum basi apertum notulas specificas inter affines sect. *Carroae* optimas praebent. — JALISCO. Real Alto. Trail to Arroyo Las Canelillas, 2500 m, Feb 22, 1927, *Ynes Mexia 1731*. — Holotypus, NY; isotypi, CAS, F, MICH, UC.

Mexia's two collections of *M. grammadenia* have long lain in herbaria under the name *Dalea nutans* (our *Marina nutans*) from which the species differs in being truly shrubby, reaching a stature of two and a half meters, in having fewer leaflets (up to but not more than ten pairs) in the principal cauline leaves, and in the form of the exceptionally large banner which is open at the base of the blade, not closed across the top of the claw into an obconic pit. In habit *M. grammadenia* resembles some forms of *M. diffusa*, but the stems of this are smooth, not roughened by small but strongly protuberant warts, and the smaller banner is formed after the pattern of *M. nutans* and all other members of sect. *Carroa* except *M. scopa*. Possibly *M. scopa* is the closest relative of *M. grammadenia*. It is, however, not a shrub but a coarse monopodial annual, differing further in the many leaflets of the main cauline leaves and in the always smaller, usually acute (not deeply emarginate) banner. In western Jalisco *M. grammadenia* is sympatric with two other fully glabrous marinas, *M. crenulata* and *M. dispansa*, species referred, because of their strongly compressed pods, to sect. *Marina*, and easily distinguished by this feature when fruit is present. The smooth, wandlike stems of *M. crenulata*, combined with its racemes of more numerous flowers, its strongly pleated calyx-tube, and its smaller banner with blade of the *M. nutans* type, provide ample differential characters at anthesis. The poorly known *M. dispansa* has the flower and smooth stems of *M. crenulata* and appears to be diffusely branched and thus of greatly different habit. The calyx of all species mentioned as possible relatives of *M. grammadenia* bears in each interval between the ribs a vertical row of sometimes contiguous but always differentiated glands. In *M. grammadenia* the glands are confluent into a continuous linear body extending from near the base of the calyx-tube to a point well beyond the sinuses of the teeth. The ten-striped calyx, unknown in any other *Marina* (but matched in one or two genuine *Daleae*) suggested the specific epithet.

Known, according to Mexia, as *Escoba amarga* or *Escoba colorada* or, according to McVaugh, as *Escobilla*, this is one of the marinas with tough, pliant twigs suitable for brooms.

38. MARINA SCOPA Barneby
(Plate XXVIII)

Coarse, erect, glabrous annuals of long duration, (2) 5–15 dm tall, simple at base, at first fastigiately then effusely and indefinitely branching to form broad-topped panicles of branchlets each terminating in a raceme of ± 2–9 flowers, the main stems pur-

ple, livid-castaneous, or stramineous, usually densely livid-tuberculate, the foliage bicolored, the membranous leaflets bright green above, pallid or subglaucescent and minutely punctate beneath, lineolate both sides, their margins gland-crenulate; *leaf-spurs* 0.3–1 mm long; *stipules* submembranous, usually purplish-castaneous, ovate- or narrowly triangular-acuminate, 0.5–1.3 mm long, the margins fimbiolate; *intra-petiolular gland* 1; *post-petiolular glands* prominent, conic or prickle-shaped; *main cauline leaves* (drought-deciduous, absent from most plants in late anthesis or in fruit) 3–8 cm long, shortly petioled, with winged rachis (0.3–0.5 mm wide on ventral face) and 8–20 (22) pairs of narrowly oblong or oblong-elliptic, obtuse but bluntly gland-mucronulate, flat leaflets (3) 4–9.5 mm long, the rameal leaves shorter, with 3–7 pairs of similar but shorter leaflets mostly 1.5–3.5 mm long; *peduncles* leaf-opposed and terminal to branchlets, 4–12 (20) mm long; *racemes* very loosely 2–9 (13)-flowered, the flowers mostly spreading from erect or narrowly ascending pedicels, the very slender or filiform axis becoming 0.5–3 (6) cm long; *bracts* embracing the young buds, early deciduous from a short, decurrent spur, ovate beyond the short, cuneate base, 0.7–1.2 mm long, the margins minutely fimbriolate; *pedicels* subfiliform, straight or flexuous, 0.6–1.2 (1.4) mm long, charged near apex with a pair of gland-grains; *calyx* 3–3.9 (4.1) mm long, the broadly campanulate tube 1.6–2.2 mm long, not strongly pleated but with elevated, cordlike ribs, the rather firmly membranous intervals charged with 2–5, mostly 3 or 4 small, discrete glands, the teeth unequal, the dorsal one longest, lanceolate, 1.5–2.6 mm long, the ventral pair broadest and shortest, deltate-ovate, obtuse, united through ± half their length behind the banner, the lateral pair ovate, subacute, all narrowly membranous-margined, minutely crenulate or gland-denticulate, usually not or only obscurely overlapping at base; *petals* bicolored, the banner with a white spot of variable extent near middle of blade, its lobes at base and sometimes its apex magenta-purple like the wings and keel, the white spot finally rubescent, gland-sprinkled like the keel, only the banner gland-tipped, the inner petals inserted near or above middle of androecium (the keel perched 3–6 mm above hypanthium-rim, the wings a little lower), the keel-blades narrowly overlapping and adherent by exterior edges; *banner* 2.6–3.8 mm long, the claw (1) 1.2–1.6 mm, the flabellately deltate or deltate-obcordate blade recurved through 45–75°, open at base, not thickened or appendaged at top of claw, 1.8–2.8 mm long, 2.4–3.2 mm wide, commonly acute and gland-mucronate, the apical gland rarely recessed into a shallow sinus; *wings* 3.5–5 mm long, the claw 0.2–0.4 mm, the obovate blades 3.5–4.6 mm long, 2.1–3.2 mm wide; *keel* 4–5.2 (6.6) mm long, the claws 0.5–0.8 mm, the oblong-obovate blades 3.6–5.2 (5.9) mm long, 2.2–3.8 mm wide; *androecium* 10-merous, 5.5–7.5, rarely 8–10.5 mm long, the filaments free for 1.2–1.7 (2) mm, the connective gland-tipped, the bluish anthers 0.5–0.65 mm long; *pod* turgidly obovoid, nutlike, (2) 2.2–3.1 mm long, (1.7) 2–2.6 mm diam, the very short style-base lateral, crested ventrally above the pore, the dorsal suture and prow smoothly rounded and not carinate, the valves firm almost from the base, charged all over with many large blister-glands appearing continuously bullate. — Collections: 98 (xiii).

Disturbed brushy hillsides, hedges, roadsides, fallow fields, sometimes an abundant weed following the harvest of corn or beans, invading gardens and waste lots in towns and villages, from near sea-level up to the edge of the oak-pine belt (but not native in aboriginal oakwoods), mostly 100–1700, in Guatemala up to 1950 m (± 330–6500 ft), colonial and common in the arid lowlands of s.-centr. Mexico and Guatemala, in Mexico mostly s.-ward from the Transverse Volcanic Belt but extending n. along the Atlantic slope into e. San Luis Potosí and s. Tamaulipas, e. into Yucatán, s., becoming rarer, through El Salvador and s. Honduras into n.-w. Nicaragua and Costa Rica; collected formerly in the coastal cordillera of Venezuela (Colonia Tovar) where probably

adventive; cultivated in Cuba. — Flowering September to February, the fruit maturing late and slowly. — *Representative*: MEXICO. NAYARIT: *Ripley & Barneby 14,054* (NY). JALISCO: *Feddema 2378* (MICH); *Ripley & Barneby 14,063* (CAS, NY). MICHOACÁN: *Moore et al. 5572* (MEXU, UC). MÉXICO: *Gentry et al. 19,607* (RENNER, US); *Ripley & Barneby 14,875* (CAS, DAO, NY). MORELOS: *Pringle 9740* (F, L, MEXU, NY); *Bourgeau 1193* (BR, P); *Ripley & Barneby 13,695* (CAS, NY, US). TAMAULIPAS: *Ripley & Barneby 14,755* (MICH, NY, US). SAN LUIS POTOSÍ: *Parry & Palmer 1047* (BR, F, K, NY). PUEBLA: *Nicolás in 1910* (L). VERACRUZ: *Sousa 2946* (MEXU, NY). GUERRERO: *Hinton 10,997* (F, NY); *Ripley & Barneby 13,720* (CAS, NY). OAXACA: *Galeotti 3163* (BR, P); *Ripley & Barneby 14,647* (CAS, IA, NY). CHIAPAS: *Breedlove 7943* (NY, US); *Ton 1890, 2053* (NY). YUCATÁN: *Gaumer & fil. 23,495* (F, NY); *Gaumer 2065* (BR, F, NY, UC, W). GUATEMALA. CHIMALTENANGO: *Standley 64,332* (F). CHIQUIMULA: *Steyermark 30,293* (UC). EL PARAÍSO: *Standley 29,408* (F). GUATEMALA: *Standley 59,254, 59,675* (F). HUEHUETENANGO: *Standley 81,350* (F); *Molina 21,184* (NY). JALAPA: *Standley 77,273* (F); *Steyermark 32,959* (F). JUTIAPA: *Standley 74,838* (F). QUICHÉ: *Standley 62,542* (F). SACATEPÉQUEZ: *Standley 58,521* (F, NY). EL SALVADOR. AHUACHAPÁN: *Standley 19,750* (NY). SANTA ANA: *Standley 3265* (F). HONDURAS. MORAZÁN: *Williams & Molina 11,238* (F); *Standley 24,890* (F). NICARAGUA. GRANADA: *Levy 364* (C). JINOTEGA: *Oersted 4594* (F). COSTA RICA. NICOYA: *Tonduz distrib. Pittier 13,565* (NY, US). VENEZUELA. MIRANDA: *Fendler 1796* (K).

Marina scopa (broom) Barneby, sp. nov., radice annua, caule monopodiali elato 5–15 dm longo, cum legumine sect. *Carroae* vexillique lamina basi aperta (nec in puteolum excavata) mediam versus glandulis plurimis conspersa apice ipso acuta ac glandula terminali praedita inter affines cito recognita. — OAXACA: roadside weed at 5800 ft (1740 m), on mountain road e. of Teotitlán del Camino, Nov 18, 1966, *Ripley & Barneby 17,729*. — Holotypus, NY; isotypus, MEXU.

Parosela nutans sensu Rydb., N. Amer. Fl. **24**: 58. 1919 magna pro parte, non *Psoralea nutans* Cav.

This is the coarse monopodial annual marina commonly encountered along highways and in milpa after the corn is harvested, flowering in the dry months of late fall and winter. In habit the plants resemble *Conyza canadensis* (L.) Cron., the virgate, usually red central stem rising unbranched at first and finally breaking out into a panicle of finely ramified branchlets. During the months of early growth *M. scopa* presents only a simple rodlike stem densely clothed with ferny foliage; but these cauline leaves drop away as the flowers develop and are seldom seen on herbarium specimens. The monocarpic nature of the plant, so evident in the field, is likewise not apparent from most dried material which, due to the height of the average plant, generally consists of only part of the panicle and does not include the short orange root. For this reason more than any other *M. scopa* is often mistaken for the related *M. nutans*, a perennial native mostly in undisturbed soils in the oak-pine belt, which is similar in the foliage but has much showier racemes of flower. The individual flower of *M. scopa* lasts only a few hours, the inner petals ordinarily being shed by noon of the day on which they expand, and none of the laxly few-flowered racemes is likely to have, even in the morning, more than one open flower at a time. The flowers of *M. nutans* are by comparison durable, lasting one or two days, so that several may be found together, at young or full anthesis, on the same raceme axis. The flowers of the two species differ technically in the form of the banner, the blade of *M. scopa* being open at base and charged at the usually acute tip with a subapical gland, whereas that of *M. nutans* is peltate, closed across the top of the claw into an obconic cornet and usually retuse at

apex (cf. Plates XXIII and XXVIII). The two fully glabrous and annual marinas which occur locally in the range of *M. scopa*, and resemble it in habit of growth, are both much smaller and more delicately fashioned plants with smaller flowers and peltate banner; see descriptions of *M. minutiflora* and *M. stilligera*.

The species varies little except, very locally, in the development of the androecium and, as a corollary, in the position of the inner petals at full anthesis. Over nearly the whole range the fully expanded androecium is about 5.5–7.5 mm long and the keel-petals are perched below the level of the longest calyx-tooth, at a point about 3–4 mm distant from the hypanthium-rim. In a small area in the Balsas Depression in s.-e. México and adjoining Guerrero and Michoacán the androecium is commonly 8–10.5 mm long, carrying the keel well out beyond the calyx to perch 4–6 mm distant above the hypanthium. Specimens of this kind, which may perhaps deserve infraspecific taxonomic rank, have been collected several times around Zitácuaro and San José Purua, where they seem to replace the commoner form, but the geographic segregation is less clear, or unproven, in adjoining México (cf. *Ripley & Barneby 13,395, 14,810, 14,875, Mexia 8794* (all NY) and *Moore et al. 5572*, already cited supra).

No specimen of *M. scopa* is known to have been collected by Haenke, Sessé, or other of the earliest botanists active in Mexico, despite its abundance around centers of population such as Oaxaca, Cuernavaca, and Guadalajara. By the time specimens of it began to accumulate in European herbaria a tradition quickly formed that this was the *Psoralea nutans* of Cavanilles, which had been collected by Feé, Sessé, and others, and named from plants cultivated in Madrid. Following this example, Rydberg (1919) treated genuine *M. nutans*, of which he had not seen the typus, as *Parosela submontana* and the present species as *P. nutans*; only by this mischance has *M. scopa* gone until now with no name of its own.

The root of *M. scopa* is said to yield a dye, yellow (acc. *Lumholtz*, F), or modified with limewater red (*Román S. Flores*, F). In Morelos I have seen market-bound donkeys laden with the baled plants, which are tied in bunches and form serviceable brooms.

By day a dowdy weed, *M. scopa* is transformed by early morning into a thing of beauty. Shafts of oblique sunlight then illuminate the panicle into a tangle of lustrous red branchlets along which are strung innumerable small but vivid flowers of glowing magenta-purple. With every breath of air the whole mass of thready stems moves and bends, the oddly insectlike flowers seeming to hover rather than hang among them. Shaken, the petals fall readily away and left untouched all flutter earth-ward as the day brightens. The long androecium, briefly extended at full anthesis of the flower, soon afterward coils back neatly toward the slowly forming pod.

IV. DALEA Lucanus

Herbs (perennial, monocarpic)and shrubs, some attaining treelet stature, the stems, leaves, and usually the flowers containing secretory vesicles (herein called glands) charged with aromatic oils, these taking the exterior form of lens-like, hemispherical, grainlike, or prickle-shaped blisters, the plant body, sometimes only the orifice of the calyces, ± pubescent with spiral, when dry nearly always rufescent hairs; *stipules* herbaceous or subglandular; *leaves* imparipinnate (*D. similis* paripinnate) or rarely trifoliolate, the terminal leaflet either elevated above the last pair or sessile and forming with the last pair a palmate trefoil, the leaf-rachis narrowly green-margined and commonly bearing at insertion of the petiolulate or sessile leaflets a pair of glands in front and a pair behind, these termed *intra-* and *post-petiolular*, the intrapetiolular pair sometimes confluent into a single gland; *inflorescence* a spike or a raceme, moderately or quite loose when racemose, loose to very dense when spicate, when ex-

tremely dense and hard termed herein conelike; *calyx* subtended by a deciduous or persistent bract and by 2 usually minute, sometimes spiculiform, sometimes obsolete, glandiform braceoles, these situated either on the rachis of spike or on the individual pedicel; *tube* of calyx 10 (*D. galbina* 20)-ribbed, 5 produced into apex of teeth and usually excurrent as a gland-tipped mucro, the arms of the 5 alternate ones, Y-forked below the sinuses between the teeth, produced into the teeth and normally anastomosing with the adjacent rib to form a gallery of closed panels, these often differentiated in texture, membranous or hyaline and charged with 1–several ranks of glands arranged in patterns characteristic for the species, but the panels sometimes glandless, sometimes firm; *teeth* of calyx varying from low-deltate to ovate, triangular, subulate, or elongately caudate-aristate, their margins often charged with 1 or more glandiform spurs; *petals* all white or of various colors (blue, purple, pink, ochroleucous, yellow, if yellow often fading orange, brown, black), the banner either concolorous with the rest or very often opening pallid (white, yellowish) or with pallid eye-spot and early rubescent, contrasting with ± anothocyanic wings and keel; *banner* either longer or (commonly) shorter than the detached keel, its blade either plane or variously hooded and at base thickened or there recessed into an obconic pit (cornet); *wings and keel,* herein termed collectively *epistemonous petals,* perched on and (except in few spp. of sect. *Theodora*) disjointing from sockets on the androecial column, the keel-blades either free in vernation, or narrowly imbricate and adherent by their overlapping faces, or valvately coherent into a conventional navicular keel, the wings, exceptionally also the keel, in some advanced annual spp. degenerate or 0; *androecium* usually 10-, sometimes 9-, in sect. *Kuhnistera* exactly 5-, in several spp. of subgen. *Dalea* indefinitely 5–10- but functionally 5-merous, the sheath cleft to various depths into a tassel, sometimes down to the petal-sockets; *anther-connective* often gland-tipped; *pollen-grains* tricolpate, operculate, commonly prolate, rarely spheroidal, in some spp. of sect. *Theodora* "amphisbaenoid" (narrowly oblong and enlarged at either pole); *pod* varying in outline from obliquely obovate to deltate, the ventral suture straight, slightly concave, or slightly convex, grooved on back and provided behind the attachment of the ovarian funicles with a small pore, the ventral suture always longer, curved or abruptly bent through more than half a circle, filiform or sometimes dilated distally; *style* filiform, or somewhat dilated distally, the stigma (maturing with or after the pollen) minute or rarely subcapitate; *ovules* 2, collateral, only 1 fertile; *seed* moderately compressed, notched at the punctiform hilum, the coat smooth; x = 7, rarely (sect. *Theodora*, perhaps subgen. *Psoropteris*) 8.—Spp. 161 (described; certainly somewhat more), dispersed over much of temperate, prairie, desert, and both arid-tropical and montane-tropical North America, most abundant and diverse in Mexico, with secondary focus of speciation at moderate and high elevations along the Andes of South America from Colombia to n.-w. Argentina and n. Chile, a few circum-Caribbean, 1 on Islas Galápagos, 2 adventive in extra-Andean South America n. of the Equator, 1 fully naturalized in Islas Filipinas, in North America absent from the w. slope of the Sierra-Cascade axis and from the Atlantic slope of the Appalachians n.-ward from North Carolina, a few n. over the plains into prairies of s. Canada. Xerophytes (with trifling exceptions), avoiding tropical forest, abundant and highly developed in the oak-pine woodlands of intertropical Mexico and Central America.

Dalea Lucanus[7], Linnaei Opera Varia (Soulsby Cat. no. 9) 244. 1758, nom. conserv. (Dandy, Regn. Veg. **51**: 15, 45. 1967); non Dalea Mill., 1754. — Generitypus, *Dalea* L., Hort. Cliff. t. 22. 1738 = **Dalea cliffortiana** Willd.

My concept of *Dalea*, as defined in the foregoing keys to genera of Amorpheae and to the four genera described herein in monographic detail, can be expressed by the equation: **Dalea** = (*Parosela* sensu Rydb., − **Marina** sensu Barneby) + *Thornbera* Rydb. + (*Petalostemum* Michx. *Kuhnistera* Lamk.). In number of species it maintains almost the same compass as *Parosela* sensu Rydb. (1919–20; 1928), the loss of *Marina* being compensated by the accessions of *Thornbera, Petalostemum*, the Andean daleas, and species subsequently described. The genus is no longer characterized by insertion of the epistemonous petals at one particular level (or levels) between the hypanthium and the separation point of the filaments or by the number of functional stamens, but by attributes, seemingly more fundamental, of ovule- and chromosome-number. The generic character is drawn so as to embrace all Amorpheae furnished with epistemonous petals combined with two collateral ovules and a basic chromosome complement of seven or (rarely) eight; thereby excluding *Marina* (uniovulate) and *Psorothamnus* (with sessile petals), both of which have, so far as known, a basic chromosome number of ten.

The advantage of this comprehensive concept is its impregnable boundary: no species is doubtfully included or doubtfully excluded from the fold. The disadvantages are two: an internal heterogeneity, almost inevitable in genera of comparable size. but less extreme than found in *Parosela* sensu Rydberg; and the disappearance into synonymy of *Petalostemum*, long familiar and therefore dear to botanists in North America, especially in United States. The reduction of *Petalostemum* and, as a corollary, that of *Kuhnistera*, is nothing new, however. These genera were combined with *Dalea* long ago by Jussieu, Ventenat, and Sprengel, and in modern times by Shinners (1949), who provided most of the ensuing new names or combinations. The reduction of *Thornbera* will be less keenly felt; the species are largely Mexican and therefore less well known, and the genus has been taken up, since its publication, by only one author of note (Wiggins, 1940). Rydberg included in his concept of *Thornbera* (1920) the generitype of *Dalea* as currently received (nom. conserv.), a fact that has no bearing on the taxonomic validity of *Thornbera* as a genus, but pretty well ensures its status as a synonym.

The proposed segregates from *Dalea* sens. lat. have always been characterized, entirely or principally, by floral characters, in particular the shape of petals and the height of their insertion on the androecial column, the cohesion or separation of the keel-petals, and the number of stamens. There is great diversity between species and between groups of related species in duration of the root and in growth-habit, in leaflet-number, in density of the spike (or raceme), in form of the interfloral bracts and the timing of their fall, in charac-

[7]The anonymous citizen of Lucca, editor of *Opera Varia*, who accidentally provided technical validation of Dalea "Linn.", a genus explicitly, repeatedly, and in all his major works from 1753 onward rejected by Linnaeus himself. The point is discussed by Barneby (1965) and by Dandy (Regn. Veg. **51**: 15, 45. 1967), who has pointed out that there is nothing in the International Rules to disqualify *Opera Varia* as a medium of valid publication. However the Code requires that an author accept his own taxonomic decisions unequivocally at the moment of publication. A *Dalea* Lucanus, nom. conserv. is acceptable, but a *Dalea* Linn. is possible only if the starting-date for the Phanerogams can be put back to *Hortus Cliffortianus*, 1737. In any other circumstances "*Dalea Linn.*" incorporates a falsehood.

ters of the calyx (especially of the teeth), in pubescence and glandular ornament, and even in seldom noticed features of the nearly always included, consistently one-seeded pod. However, no convincing segregate of generic quality can be defined by any combination of these characters, even though a particular type of flower, when associated with a peculiar type of bract, or gland, or leaflet, may lend substance to what is intuitively perceived as forming a natural, though weakly differentiated group. Most of these minor features will receive due notice in the discussion of subgenera, sections, and series of *Dalea* in the following pages. My concern here is to defend the subordination to *Dalea* of the genera *Petalostemum* (including *Kuhnistera*) and *Thornbera.*

The genus *Petalostemum* has been much studied lately, in part by Isely (1962), on a monographic scale by Wemple (1970), and independently, in connection with this revision, by myself. Wemple refined the classical concept of *Petalostemum* by rejecting from the genus all annual species hitherto referred to it, and based his defense of the genus, so purified, on the fact that it is a clearly monophyletic group of species, of substantial numbers, with a long taxonomic history separate from that of *Dalea.* As defined by Wemple, *Petalostemum* consists of perennial herbs with spicate flowers, free epistemonous petals perched at the separation-point of the filaments, and an androecium reduced to exactly five stamens, the vexillary one and those alternate around the cycle being fully suppressed. Its generic character is so drawn as to include *Kuhnistera* Lamk.; with this I have no quarrel. In generic keys Rydberg (1919; 1928), following a tradition of long standing, emphasized the number of stamens as the prime character of *Petalostemum*, but Wemple rightly rejects as artificial a genus delimited by this feature alone. The series *Exiles* of Rydberg's revision (1920, pp 121–2, in clave) consists of five species which share most features of the conventional *Petalostemum* corolla. The epistemonous petals are free in vernation and perched high on the androecial column, but the androecium itself is not always reduced to exactly five stamens, more often, indeed, to five functional stamens alternating with one or more interposed, vestigial filaments, or sometimes to an uncertain number of perfect stamens varying from five to seven or eight in flowers of the same spike. Two of the five *Exiles*, because they were originally described in *Petalostemum* and have been accepted as such (except by Shinners) until rejected by Wemple, are of special interest here. One, *P. exilis* Gray (*Dalea exigua* Barneby), is related to *Dalea cliffortiana* Willd. (generitype of *Dalea*) and several close kindred, a group of obligately annual species in which, collectively, all stages of decadence of the androecium from obligate decandry to constant pentandry are observed. The perianth of *D. exigua* is in essential features duplicated in *D. emarginata* (T. & G.) Shinners (*P. emarginatum* T. & G.), which has a normally pentandrous flower and then differs from genuine *Petalostemum* only in a short-lived root and rather short tassel of separated filaments, a character discussed further below. This interesting species, unlike *D. exigua*, has no obvious or close relative in *Dalea.* Its pod is curious, having a dorsal suture dilated under the style-base so as to form a broad prow along the leading edge, a feature shared by no perennial *Petalostemum*, it is true, but approximated in *Dalea* only by some few species (cf. *D. foliolosa*; *D. nana* & aff.) characterized by united keel-petals inserted low on the column of an included, decandrous androecium. The foliage of *D. emarginata* often assumes in drying a verdigris discoloration characteristic of several impeccable *Petalostema* but encountered in only two yellow-flowered daleas extremely unlike *D. emarginata* in all other respects. This species seems as isolated in *Dalea* as in *Petalostemum.* Yet another annual dalea, this described after Rydberg's revision as *Petalostemum tripetalum* P. G. Wilson, has the androecium almost of *D. exigua* but is not related to it. The species was based on one of a series of forms, dispersed from Arizona and southern New Mexico south into central Mexico, in which all steps between a decandrous and a pentandrous androecium, often accompanied by loss of one or both pairs of inner petals, are encountered within what I consider to form a single polymorphic species, *D. urceolata* Greene. The kinship of *D. urceolata* to the common, 9–10-androus *D. leporina* was perceived by Rydberg and is not disputed. Independently of all these, far distant in Peru, appears *D. moquehuana* Macbr., likewise annual, with an androecium composed of

five functional stamens with some vestiges of alternating filaments, but these enclosed in the conventional papilionaceous keel of sympatric perennial daleas with normal androecia. One further member of ser. *Exiles* Rydb., which was first described as *Dalea evanescens* Brand. and has an androecium quite similar to that of *D. exigua*, is in reality not a *Dalea* at all, but a *Marina*. It is mentioned in this context to stress what must be already obvious, that the degeneration of the androecium, involving full or partial loss of the five petal-opposed stamens, has occurred separately, more than once, in the evolution of *Dalea* sens. lat.

Much has been made of the fact that in *Petalostemum* the inner pairs of petals are inserted on the androecium at the same level at which the filaments separate, a point often described as "at top of the staminal sheath"[8], in contrast to the petals of *Dalea*, which may be inserted at any point between base and top of the sheath but not at either. While the phrase "top of the sheath" is descriptive, it implies, misleadingly, that the petals of *Petalostemum* have migrated further outward along the androecium than those of *Dalea*. It appears equally sensible to attribute the apparent great height of petal insertion in *Petalostemum* to the relatively great depth of the interstaminal sinuses which are in effect recessed back to the level of the petal-sockets. It is this relationship between the sockets and the sinuses which gave rise to the discredited notion that the petals of *Petalostemum* are dilated staminodes, for they appear as it were to alternate with the stamens in a single whorl. In some such typical *Petalostemum* as *Dalea candida* W. the androecial column and the free filaments are of about equal length, and the petals are borne about half-way between the hypanthium and the anthers. In a number of decandrous *Daleae* the petals are borne well above the middle of the whole androecial structure, but, because the filaments are less deeply separated, perch below the top of the "sheath." The remarkable feature of the *Petalostemum* androecium, apart from its reduction in stamen-number, is the length of the tassel of free filaments relative to the length of the column. However, in the series of *Daleae* that includes *D. pringlei* Gray and *D. grayi* (Vail) Wms., that is the perennial species which formed the nucleus of the genus *Thornbera* Rydb., one encounters the same proportionately long tassel and short column, combined moreover with free epistemonous petals inserted midway or nearly so. These perennial daleas of the *Thornbera* type differ from *Petalostemon* essentially only in that they retain ten or sometimes only nine stamens.

The morphologically very distinct and isolated *Dalea obovata* (T. & G.) Shinners was originally described as a *Petalostemum*, redescribed independently by Moricand as *Dalea agastachya*, recognized by Rydberg as a *Petalostemum*, transferred to *Dalea* by Shinners, and finally accepted as good *Petalostemum* by Wemple, who considers it related most nearly to *P. macrostachyum* Torr. (*Dalea cylindriceps* Barneby). Its taxonomic position remains controversial, however. While its flower resembles that of *D. cylindriceps* in form and position of the petals, its androecium shows here and there a vestige of a sixth, exceptionally of a seventh sterile filament; furthermore the tassel of free stamens is relatively short, and the root, although not obligately annual (as described by Turner, 1959) often does perish after the first season of bloom (! verified in the field). Thus it might with propriety, as it seems to me, be interpreted along with *D. emarginata* as a greatly reduced *Dalea*; the dense, loose pubescence of the foliage and the shape and membranous texture of the pod being likewise more suggestive of some annual or short-lived perennial *Daleae* of Mexico than of any characteristic *Petalostemum*. However that may be, it seems to me as impossible to draw any generic line between a *Dalea emarginata* and a *Petalostemum obovatum* (which Wemple advocates) as between a *Dalea obovata* and a *Petalostemum macrostachyum*. The three species have more in common, in my view, than *Petalostemum*

[8] The terminology depends on interpretation of the tissue intervening between the hypanthium rim and the sockets in which the petals take their origin. If this is receptacular in origin, as I have supposed, the true androecium begins at the sockets. If this is so, the stamens of *Petalostemum* are free to the base, the so-called sheath being an adventitious column supporting them.

prostratum Woot. & Standl. (*Dalea scariosa* Wats.) and *Kuhnistera pinnata* (Walt.) O. Kze. [*D. pinnata* (J. F. Gmel.) Barneby], sterling *Petalostema* both.

By comparison with that of Rydberg, Wemple's exclusive concept of *Petalostemum* is a refined one. It is only unfortunate that the devaluation of the old numerical character, the exact and convenient basis upon which *Petalostemum* historically rests, has not been accompanied by discovery of stronger supporting ones. As it now stands, *Petalostemum* sensu Wemple is a more natural genus than formerly, but a technically weaker one. The exclusion from it of *P. emarginatum* along with ser. *Exiles* Rydb. make the genus more homogeneous; but the difficulties have not really been dissipated, simply shifted out of *Petalostemum* into *Dalea*. In foregoing paragraphs I have tried to show how the characters of *Petalostemum* which Wemple finds diagnostic as a syndrome all occur separately in some group or in some individual species of *Dalea*. There remain, even so, some few species genuinely ambiguous. This policy, adapted to the particular end of saving *Petalostemum* at the level of genus, would have far-reaching consequences if applied to *Dalea* sens. lat., in which a dozen genera of the same or equivalent virtue lie concealed.

Larger genera are described and thereby provisionally defined long before their full content becomes known. This is particularly true of genera highly diversified in the interior of continental land-masses, genera of which the geographically outlying species are likely to be the first described. Just as the peripheral population of a species, which furnishes the nomenclatural type, often turns out to be atypical of the species, so the first members of genera, discovered at the limit of the generic territory, are likely to be atypical of their kindred. It follows that the initial definition of a genus, however accurate for the members known at the time, often proves untenable, incomplete, or actually misleading later on, as the true boundaries of the genus come into focus. At first landfall the explorer sights two heights of land standing on the horizon and turning back without reaching shore reports the discovery of two independent islands. Subsequent travellers may confirm the report; or may find an archipelago surrounding the old landfall; but just as likely the peaks resolve at close quarters into lofty summits rising from a continuous, perhaps elaborate piedmont. As surveys progress, old maps give way to new. So with genera, as knowledge of the species grows, and as the species themselves multiply before the eyes, redescription and redefinition are required.

Situations of this sort are neatly exemplified by *Dalea*, sens. lat., an assemblage of (depending on taxonomic judgment) some 160 species of xerophytic papilionate Leguminosae ranging from the Canadian prairies (above 50° N) south to Chile's nitrate coast and the west edge of the Argentine pampa (near 33° S). The present centers of diversity and of abundance, alike of individuals and kinds, coincide over an oblique crescentic land-mass with its northern horn pointed to the Colorado Desert in California and its southern to Guatemala City, its outer curve following that of Mexico's Pacific coast and its inner drawn to include the whole Mexican plateau and the Transverse Volcanic Belt. There are, to be sure, some common species widely dispersed beyond this area, as in southern United States and along the Andes from Colombia into Peru, but with one notable exception (the perennial pentandrous species which make up the bulk of *Petalostemum*) all the major types occur within these boundaries and many are found there alone. Accidents of history and politics so hampered and delayed botanical exploration of Mexico that many daleas, including some of the most striking and ambiguous types, were unknown to the systematists of the XIX century who formulated most of our ideas about generic limits. It seems likely that if *Dalea grayi* had been found first, and the taxonomic history of the genus had proceded from that point outward, no one would have felt the need to segregate the pentandrous perennials as a genus, at least unless accompanied by recognition at the same taxonomic level of equivalently discrepant types. At the time L. C. Richard worked out the character of *Petalostemum* for Michaux's Flora he had in hand not over half a dozen miscellaneous daleas, all from eastern United States, and completely misunderstood the original *Dalea* of Linnaeus, which was then not represented in any Parisian herbarium.

Up to this point I have spoken of generic characters as though they existed chiefly for the benefit of the taxonomist, almost as though their evolutionary and biological significance were irrelevant. I wish to correct that impression by saying a few words about the organization of the *Dalea* flower, which alone (as already mentioned) seems to furnish differential characters of fundamental importance within the tribe. In terms of function, the *Dalea* flower takes three forms: 1) the dalea-type, in which the perianth at full anthesis stands apart from or below the androecium so as to offer free and abundant pollen to a variety of lepidoptera, flies and smaller insects generally, or to the wind; the anthers may be carried out beyond the petals, or stand about level with the petal-tips, but are always presented in plain view; 2) the parosela-type, in which the entire androecium is permanently concealed between the two inner epistemonous petals, a device calculated, as it seems, to favor pollination by heavier, probing insects, particularly bees; and 3) the autogamous type, apparently independently developed from each of the two foregoing, in which the perianth tends to become small, inconspicuously colored, and fugacious, a state leading to and eventually achieving obligate cleistogamy. It seems reasonable to suppose that the variety of form and proportion seen today in the *Dalea* flower has evolved in relation to pollination processes working within the context of a given hereditary potential, and it is on this assumption that my classification of the genus is built.

The flower of the dalea-type exhibits, in a variety of combinations, some or all of the following peculiarities. The banner is the longest petal, the epistemonous ones projecting beyond it (at full anthesis) only because carried up on a strongly developed column; and its blade is neither conspicuously thickened at junction with the claw, nor recessed there into a cornet, nor furnished at base, on either side, by a pocket formed by adherence of each basal lobe to the blade behind it. The epistemonous petals are short-clawed, with basal auricle either poorly developed or obsolete, and the inner pair tend to resemble the wings both in size and shape; the blades of the inner pair are either completely free even in vernation or, if at all united adhere only weakly to each other by their narrowly imbricate outer margins. The whole perianth tends to be concolorous, the banner not offering a marked color-contrast with wings and keel and not or only inconspicuously rubescent after fertilization of the ovary. In general the life of the expanded petals is short, though they are often retained as withered remnants caught between the densely crowded calyces. Fragrance is a common attribute.

All instances of complete loss of the five petal-opposed stamens are associated with the dalea-type of flower, and most of the known incipient ones, the loss of the vexillary stamen being especially common. Complete loss of all five stamens appears to have occurred independently several times, but achieved stability prior to speciation only in the forebears of sect. *Kuhnistera* (= *Petalostemum* Mchx.). The depth to which the interstaminal sinuses of the androecium are cut back, resulting in a longer or shorter tassel of free filaments, is not firmly correlated with stamen number and bears little relation to the level at which the petals perch. The level of the petal-sockets in relation to the calyx is determined by the development of the column below them; but their level in relation to the whole androecial structure, or to that part of it below the tassel which is described in literature as the staminal sheath but is actually composed of sheath and column combined, is determined by the proportionate development of three independent variables, column, sheath, and tassel. Permutations of the three variable elements yield surprisingly different results, but it is ultimately the relation between the flower-parts in situ, rather than the points of insertion or the degree of union, which determines the flower's facies and function.

The dalea-type flower is found throughout *Petalostemum* (including those species excluded by Wemple) and *Thornbera*, as treated in Rydberg's revision (1920), as well as in these series of Rydberg's *Parosela* subgen. *Euparosela*: *Lagopodes* (except *P. lagopina*), *Urceolatae*, *Polygonoides* (except *P. fissa*), the last three species of *Alopecuroides*, *Arenariae*, and *Lumholtzianae*. All of these, with a few described herein, comprise my subgenus *Dalea*, further divisible into several sections.

The flower of the parosela-type is characterized by some or most of the following features: The banner is the shortest petal, not only because it projects least far from the calyx but because the keel, even when detached from its sockets, is longer. The banner blade is commonly thickened at junction with the claw and often recessed there in the form of an obconic pit or cornet, or its basal lobes are infolded and adhere to the blade behind them to form little lateral pockets. The epistemonous petals are ordinarily long-clawed and perch on a relatively short column commonly greatly oblique distally; their blades are strongly auricled on the inner side and those of the keel nearly always are substantially longer and wider than the wings. The blades of the inner pair are even in vernation exactly valvate and coherent by their external margins, at anthesis expanding to form a conventional keel which encloses the androecium and protects the pollen. The perianth is often strikingly bicolored, the epistemonous petals being some shade of blue or purple in contrast to a banner that opens white or pale yellow but fades to dull red or pink after fecundation of the ovary. The blade of the banner, more or less hooded and overhanging the base of the wings and keel, is marked with a distinct eye-spot, often gaily gland-sprinkled, which transmits sunlight striking it from the back; while the wings are displayed at an angle obliquely horizontal to the vertical keel-blades, standing out on either side to provide foothold to the bee attracted to the banner's luminous bait. The petals are generally of more solid substance than those of the dalea-type, lasting through more than one, often through several days; fragrance (so far as I have noticed in the field) is commonly faint or none.

The *Daleae* characterized by flowers of the parosela-type are numerous and comprise most of the taxonomically critical complexes in the genus. With trifling exceptions all those known to Rydberg were referred to his *Parosela* subgen. *Euparosela*, distributed through ser. *Similes, Citriodorae, Capitatae, Frutescentes, Acutifoliae, Cyaneae, Tuberculatae, Psoraleoides, Pilosissimae, Pectinatae, Mucronatae, Pogonatherae, Aureae, Sericeae, Versicolores, Crassifoliae, Lasiostachyae, Formosae, Microphyllae, Leucostomae,* and *Thyrsiflorae*, together with *P. fissa* and those *Alopecuroides* not mentioned above as of the dalea-type. To these must be added all the South American *Daleae* (not treated, of course, in *North American Flora*), and a considerable number of species discovered since Rydberg's revision (1920). Collectively these comprise my subgen. *Parosela*, consisting of many disparate types further divisible into sections and series.

The third type of flower encountered in *Dalea* is that in which the colored leaves of the perianth have degenerated to a point where they can exercise little or no influence, either protective or attractive, on the course or method of pollination. The majority of these small-flowered *Daleae* are annuals, that is physiologically specialized in other ways than in the perianth. Simultaneous ripening of the pistil and anthers ensures automatic pollination, and once anthesis is past a calyx lacking a plump pod and a viable seed is a rarity. These autogamous species do not, however, seem to form a monophyletic group, but are more likely derived from forebears in part of the dalea- and in part of the parosela-type. Thus *D. humilis* G. Don (= *Parosela inconspicua* + *P. ervoides* sensu Rydb., 1920) is related, not to the annual and similarly small-flowered, daleoid *D. leporina* (Ait.) Bullock but to the perennial, showy-flowered *D. sericea* Lag., of which it retains, in miniature form, the closed keel of the paroseloid flower. The annual *D. mixteca* Barneby is clearly derived by reduction from the perennial or perennant *D. obovatifolia*, while the Chilean *D. moquehuana* is apparently an annual offshoot of the perennial Andean species with showy flowers of the parosela-type. On the other hand *D. obovata*, with its colorless little tabs of petals, or *D. plantaginoides*, a relative of *D. cliffortiana* characterized by tiny, fleeting, whitish petals thrown off as they expand, seem surely derived from more colorful ancestry of the dalea-type. Because the autogamous (cleistogamous) flower, however significant biologically, must have arisen (as also in *Marina*) several times independently, as an end-product of different evolutionary lines, it is of taxonomic use only at the specific level. Accordingly I have distributed these species as nearly as possible near or among their relatives in the two subgenera *Dalea* and *Parosela*.

The contrasts that have been brought out in discussion of the *Dalea* and *Parosela* branches of the genus are relatively strong ones. If the differential characters, disregarding for the moment the convergently cleistogamous element in each branch, were universally correlated, there would be good reason to divide the genus into two. There are, however, obstacles in the shape of a few species, most of them strongly individual and taxonomically isolated (or representing small isolated species-groups), which conform only imperfectly to the ideal formulae of *Dalea* and *Parosela*. Thus *D. obovatifolia* (with two relatives) has a small, high-perching but valvately united keel with a large banner unappendaged at base of the blade; the proportions of the flower are daleoid but the keel is paroseloid. These or similar conditions are found in *D. macrostachya*, *D. quercetorum, D. caeciliae, D. sericea*, and in the semicleistogamous *D. filiformis*. Two remarkable species, *D. viridiflora* and *D. leucostachya*, share the unexpected syndrome of an androecium far exserted from a valvately united keel, a contradictory arrangement which I can only interpret as the result of evolutionary reversal. These two species are otherwise quite unalike. Except for the protruded stamens *D. viridiflora* resembles and is probably at least indirectly related to *D. hegewischiana*, a species of marked paroseloid complexion. The affinity of *D. leucostachya*, which with its var. *eysenhardtioides* comprised an autonomous series in Rydberg's revision, is obscure; its uniformly white petals, the banner longest, plane, the epistemonous ones subisomorphous and only minutely auriculate, and its deeply divided tassel of filaments suggest the decisively daleoid *D. albiflora* (generitype of *Thornbera*); but the growth-habit, and especially the panicles of loose, catkinlike flower-spikes suggest *Amorpha* or *Eysenhardtia* more than any particular *Dalea*. The unique *D. lanata*, a species widely dispersed (and variable) on dunes over much of south-central and southwestern United States, has many of the floral characters of *D. leucostachya* exactly reversed. Here the banner is peltate, excavated at top of the claw into a recessed pit, matched elsewhere only in flowers of extreme paroseloid development; but the tiny, fugitive, epistemonous petals, vivid magenta like the banner but much shorter than it, perch far out on a long column but well below the short tassel of nine filaments. Wings and keel are much alike in size and shape, and during their brief anthesis are displayed laterally, one pair above the others, at an angle obliquely horizontal to the long axis of the androecium. All of these peculiar daleae which depart in some or at least one important feature from the idealized types so far defined might be brought together to form a third subgenus, as it were intermediate between *Dalea* and *Parosela*. I fear, however, that it would be an artificial category and a fundamentally heterogeneous assemblage. In practice I prefer to divide them between subgen. *Dalea* and subgen. *Parosela*, using the adhesion of the keel-petals as the deciding factor wherever matters are in serious doubt. In a few cases the decision, one way or another, seems arbitrary, but no better suggests itself.

With these controversial species disposed of, it remains only to discuss those elements of *Parosela* subgen. *Trichopodium* sensu Rydb. which could not be accomodated in *Marina* and have not yet found any place in *Dalea*: ser *Lachnostachydes* Rydb. (except *P. sericocalyx*) and the singular *D. filiciformis*. This group of eight species is characterized by flowers, always pedicellate, of a type intermediate between those of *Dalea* and *Parosela* in which a relatively ample, unappendaged banner is combined with an imbricately coherent keel that surrounds the androecium. The petals are nearly those of some *Marina*, but the long, setiform calyx-teeth, encountered otherwise only in subgen. *Parosela*, the pubescence of spiral hairs, the two collateral ovules, and the non-lineolate leaflets are all characters of *Dalea*. In the early stages of my study of *Dalea*, this group of species presented an awkward problem in classification as it seems to reduce the discontinuity, even though it forms no convincing bridge, between *Dalea* and *Marina,* perhaps fruther involving a relationship also with *Psorothamnus*. Mosquin's discovery that most of these species have eight pairs of chromosomes, not seven (or multiples thereof) as found in all other *Daleae* of which the caryotype is known, emphasizes their peculiarity.

The ser. *Lachnostachydes* Rydb. actually consists of two species-groups, both characterized by flowers nodding at maturity (as those of some marinas) and by the presence on the keel of one or more small glands situated at junction of blade and claw, two features foreign to all other *Daleae*. In sect. *Lachnostachyae* (Rydb.) Barneby, consisting of only two species, *D. lachnostachya* and *D. erythorrhiza*, the young buds are enveloped in remarkable flask-shaped bracts, the blade of the banner is ovate, the petals are bright blue, the style is thickened upward (as in *Parryella*), and the prow of the pod is greatly distended laterally below the style-base so as to form a sort of double keel. This pair alone has the normal *Dalea* caryotype, x = 7. The second series, sect. *Theodora* Barneby, consists of five species, of which *D. mollis* and *D. neo-mexicana* are typical and familiar. It differs from sect. *Lachnostachyae* in having plane bracts, an obcordate banner, pale-pink to dull purplish petals, a filiform style, and a pod not at all thickened along the prow. Seven counts covering four of the five species have yielded x = 8. A notable feature of some (but not all) species of sect. *Theodora* is the fact that the keel-claws do not disjoint from sockets (as in all other *Daleae*) but appear to be truly adnate to the androecium, not perched on a column. Because so many characters peculiar in the context of *Dalea* are found together in the members of these two small sections, I propose to treat them as forming a third subgenus, *Theodora* Barneby, so named in honor of Theodore Mosquin, whose invaluable cytological data, generously shared when unpublished, contributed heavily to the formulation of generic and subgeneric concepts adopted in this revision.

It remains only to find a place for the taxonomically isolated *D. filiciformis*, a dalea of preeminently idiosyncratic facies due to its long lax raceme of few large flowers which ascend from the axis on slender pedicels. A relationship to sect. *Lachnostachyae* is suggested by the very similar flask-shaped bracts which envelop the young flower-buds, but the petals and the pod are so different that it cannot be a close one. The presence of eight pairs of chromosomes invites comparison with sect. *Theodora*, but close similarities end there. Remarkable individual features of *D. filiciformis*, apart from the distinctive foliage and inflorescence, are a banner densely sprinkled with glands over the whole blade, coarsely venulose epistemonous petals which recall those of *Psorothamnus*, and a pod which, detached from the plants, is that of *Marina* rather than *Dalea*, bearing on each face two distinct crescents of blister-glands. The petals of *D. filiciformis* vary in color, being mostly commonly dull pinkish-purple, as in typical *Theodora*, but sometimes blue as in *Lachnostachyae*. The species appears from all sides to be a detached monotype which may well form by itself a fourth subgen. *Psoropteris*.

There follows, in summary, a synopsis of *Dalea* carried down to the level of sectio. Some remarks on the interior phylogeny of the genus form part of the introductory discussion of tribe Amorpheae.

Synopsis of Genus *Dalea*

A. *Blades of keel-petals adherent by their imbricate margins and containing the androecium; flowers pedicellate; calyx-teeth elongate, plumose.*

I. Subgenus PSOROPTERIS Barneby — Flowers loosely racemose, ascending; flower-buds enveloped by clasping, membranous bracts; keel-blades gland-sprinkled but lacking glands at junction with the claw; pod (of *Marina*) charged on either face with 2 distinct crescents of blister-glands; x = 8. Suffrutescent herbs, becoming broomlike (Mexico). Monotypic.

II. Subgenus THEODORA Barneby — Flowers densely racemose, nodding at and after anthesis; keel-blades charged at top of claw with 1–2 glands; either bracts of subgen. *Psoropteris* or same chromosome number (but not both). Low xerophytic herbs, rarely monocarpic (n.-w. Mexico and s.-w. U. S.).

II (i). Sectio **Theodora** — Bracts plane, narrow; blade of banner obcordate; style filiform; ventral suture of pod not thickened; x = 8. Spp. 5.

II (ii). Sectio **Lachnostachyae** (Rydb.) Barneby — Bracts of subgen. *Psoropteris*; blade of banner ovate; style thickened distally (suggesting *Parryella*); ventral suture of pod thickened under the style-base forming a double prow; x = 7. Spp. 2.

B. *Blades of keel-petals free, or valvately coherent, or narrowly imbricate and adherent, but if the last the flower sessile and calyx-teeth short, not plumose; x = 7.*

III. Subgenus DALEA — Epistemonous petals all free or (rarely) the keel-blades narrowly imbricate-adherent, but the adnroecium then either exserted or the stamens less than 9; epistemonous petals nearly always shorter than the banner and obscurely or not auriculate at base; flower sessile.

**Blade of banner plane, open (not peltate) at base.*

III (i). Sectio **Thornbera** (Rydb.) Barneby — Filaments 9–10, deeply cleft into a long tassel; epistemonous petals always free, usually high-perching. Herbaceous or suffruticose, perennial (w. and (1 sp.) s. Mexico and s.-w. U. S.). Spp. 9.

III (ii). Sectio **Kuhnistera** (Lamk.) Barneby — Filaments 5, deeply cleft into a long tassel; epistemonous petals always free, high-perching. Herbaceous perennials, rarely of short duration (s.-e. U. S. to s.-centr. Canada and n. Mexico). Spp. ± 20 (includes *Petalostemum* Mchx. and *Kuhnistera* Lamk.).

III (iii). Sectio **Dalea** — Filaments 10–5 (the antepetalous ones variably reduced in number or function), shallowly cleft into a short tassel; epistemonous petals free or weakly imbricate-adherent, either high- or low-perching. Monocarpic herbs (s.-w. U. S. to central Amer., 1 n. to centr. U. S. and s. to n.-w. Argentina, 1 adventive in n. S. Amer. and Philippine Is.). — Spp. 13.

***Blade of banner peltate, recessed above its base into a cornet.*

III (iv). Sectio **Elaspora** Barneby — Filaments 9, cleft into a short tassel; epistemonous petals free, low-perching. Perennial herbs, psammophytes (centr. and s.-w. U. S. and adjacent Mexico). Monotypic.

IV. Subgenus PAROSELA (Cav.) Barneby — Epistemonous petals nearly always strongly auriculate at base and the inner pair valvately coherent into a conventional keel; flowers sessile or pedicellate; androecium mostly (9) 10-merous, shallowly cleft (except sect. *Prosalea*) into a short tassel.

 # Androecium exserted far beyond the keel-petals.

IV (i). Sectio **Prosalea** Barneby — Epistemonous petals (white, as the banner) of sect. *Thornbera* except for union of the keel blades; shrubs, sometimes subarborescent, with aspect and paniculate inflorescence of *Eysenhardtia* (w. and s. Mexico). Monotypic.

IV (ii). Sectio **Viridalea** Barneby — Epistemonous petals (greenish yellow, like the banner) and aspect of sect. *Eutropis*; perennial herbs (n.-w. Mexico). Monotypic.

Androecium contained within the keel.

+Ventral suture of pod not thickened under the style-base, its leading edge (prow) filiform or simply and slenderly carinate.

IV (iii). Sectio **Parosela** — Banner longer than the detached keel, its blade open at base (not thickened at junction with claw, nor recessed as a cornet, and its basal lobes not folded back and adherent to the blade so as to form lateral pockets). Perennial and annual herbs, sometimes soft subshrubs (Mexico, centr. Amer., 1 monocarpic sp. n. into s.-w. U. S.). Spp. 9.

IV (iv). Sectio **Eutropis** Barneby — Banner commonly shorter than (rarely subequalling) the keel, or its blade closed at base and recessed there into a cornet, or the basal lobes adherent to the blade behind them so as to form pockets opening laterally; polymorphic, consisting of many series, tall and dwarf shrubs and herbs, none truly monocarpic (range of the genus s.-ward from s.-w. U. S.). Spp. ± 80.

++ Ventral suture of pod conspicuously thickened under the style-base, its leading edge either flat and corneous or strongly 2-carinate.

IV (v). Sectio **Psoropogon** Barneby — Foliage glabrous and conspicuously gland-dotted; bracts of broad outline, broadly membranous-margined, permanently (ser. *Psoropogon*) or before anthesis (ser. *Citriodorae*) embracing the calyx; petals (of sect. *Eutropis*) ± anthocyanic or white, never yellow. Herbs, perennial or (ser. *Citriodorae*) annual (centr. and s.-w. U. S. to centr. Amer., 1 adventive further s.). Spp. 4.

IV (vi). Sectio **Cylipogon** (Raf.) Barneby — Foliage pilose and not or very obscurely gland-dotted; bracts variable, but without wide pallid-membranous margins; petals (variable in relative proportions) yellow, fading brown or pinkish. Perennial herbs (Mexican plateau to s.-w. and prairie U. S.). x = Spp. 10.

V. Subgen. ASPROLEA Barneby — Leaves pinnately 3-foliolate, the large, suborbicular leaflets incipiently peltate at insertion and pinnately nerved; spikes loose, elongate; bracts very large, persistent, membranous-margined, quite or nearly concealing the calyx; petals yellow, the color unchanged in fading, the banner and keel of about equal length, the banner open at base of blade, the keel-blades valvately coherent (flower of sect. *Parosela*); pod and seed very large, the latter ± 4 mm long. Shrubby (?) or perhaps a tall herb (s. Mexico). Monotypic.

Key to the Subgenera of Genus *Dalea*

1. Blades of keel-petals either free from each other or their exterior edges narrowly imbricate and adherent by the overlapping faces.
   2. Keel-blades imbricately adherent into a conventional keel enclosing the anthers at dehiscence; *calyx* pedicellate, its teeth elongate-aristiform, plumose.
      3. Flowers loosely racemose, ascending; *keel-blades* gland-sprinkled but lacking a small gland-cluster at junction with claw; *pod* (of genus *Marina*) charged on either face with 2 distinct crescents of blister-glands; *suffruticose herbs* becoming broomlike when adult in favorable habitat; *flower-buds* enveloped by clasping, membranous bracts. Monotypic; centr. and s. Mexico. I. PSOROPTERIS (p. 147)
      3. Flowers densely racemose, nodding at and after anthesis; *keel-blades* charged near junction with claw with 1–2 glands; *pod* various, but if at all glandular the glands minute and scattered; *herbs*, perennial or monocarpic, never frutescent; *bracts* either clasping or plane. Spp. 7, of the Sonoran and Chihuahuan deserts and Central Plateau of Mexico, n. into s.-w. United States. II. THEODORA (p. 150)

2. Keel-petals usually free, if imbricately adherent the androecium exserted; *calyx* sessile, its teeth only exceptionally aristiform and plumose, the keel-petals then free. Spp. 44, widespread over continental North America, but not in West Indies or Baja California, 2 adventive in s. America and 1 in Islas Filipinas. III. DALEA (p. 167)

1. Blades of keel-petals valvately coherent by their outer edges, nearly always (exceptions: monotypic sects. *Prosalea, Viridalea*, some races of *D. bicolor*) enfolding the androecium.

4. Leaves mostly pinnate, if 3-foliolate then palmately so, or epistemonous petals purple, or if pinnately trifoliate with yellow petals the plant herbaceous, the leaflets pubescent but not obviously gland-punctate, not suborbicular or penninerved, and the pod's prow doubly crested below the style; *seeds* up to 3 mm long, mostly smaller. Spp. 109, covering the range of the genus except s.-e., centr., most of Intermountain United States and s. Canada. IV. PAROSELA (p. 284)

4. Leaves pinnately trifoliolate, the large, glabrous, suborbicular leaflets pinnately venulose and heavily gland-punctate beneath; *petals* yellow; *pod* not doubly crested; *seed* at least 4 mm long. Tall probably shrubby plants, with elongate spikes of large flowers subtended by big persistent, broadly membranous-margined, gross-glandular bracts. Monotypic; s. Mexico. V. ASPROLEA (p. 581)

I. Subgenus PSOROPTERIS Barneby

Potentially fruticose, when adult always so in frostless s. part of its range but on Mexican Plateau the stems dying back annually in dry cold season to a heavy ligneous root-stock, the smooth stems and foliage glabrous; *leaflets* 6–17 pairs, suborbicular-cordate, small and carnosulous; *inflorescence* loosely racemose, the ascending flowers distant; *bracts* spathaceous, enfolding the buds, deciduous; *pedicels* ebracteolate; *calyx* plumosely pilose, the caudate-aristiform teeth much longer than the tube; *petals* dull lavender or blue, concolorous, coarsely nerved; *banner* ample but shorter than detached keel, its liberally gland-sprinkled blade plane and open at the claw; *epistemonous* petals low-perching, the keel-blades narrowly imbricate and adherent by overlapping margins, enclosing the androecium; *pod* harp-shaped, the prow slenderly carinate, the valves charged with 2 obliquely vertical gland-crescents; x = (?) 8. — Sp. 1, of arid highland centr. and s. Mexico.

Dalea subgen. **Psoropteris** Barneby, subgen. nov. Flores laxe racemosi adscendentes; bracteae magnae glabrae alabastrum invaginantes mox deciduae; dentes calycini elongati plumosi; carinae laminae anguste imbricatae sese adhaerentes androecium totum tegentes; legumen utraque facie glandulis ordine crescentica bina dispositis praeditum. — Affines ut videtur sect. *Lachnostachyis* subgeneris *Theodorae* sed racemo laxissimo, pedicellis eglandulosis, leguminis prora simplici gracili valvulisque crescentim glandulosis procul abstantes. — Sp. unica: **D. filiciformis** Robins. & Greenm.

1. DALEA FILICIFORMIS Robinson & Greenman

(Plate XXIX)

Herbaceous, suffruticose, or (southward) becoming shrubby and up to 2 m tall, when herbaceous the stems rarely over 5 dm long, dying back yearly to the crown of a

taproot up to 3 cm diam, when shrubby effusely branching and broomlike, glabrous to the pedicels, the young stems purplish or glaucescent, densely micro-tuberculate, the old wood gray and furrowed, the foliage greenish-glaucescent, the thick-textured leaflets dotted or pustular beneath; *leaf-spurs* 0.2–1 mm long; *stipules* narrowly subulate, livid, 0.3–1.5 mm long, deciduous; *intrapetiolular glands* 0 or minute, impressed; *post-petiolular glands* small, impressed or scarcely prominent; *main cauline leaves* 1.5–4 (4.5) cm long, shortly petioled or subsessile, with subterete, narrowly grooved, punctate rachis and (11) 13–29 orbicular, ovate, broadly oblong-ovate, or cordate, emarginate or very obtuse, flat leaflets 1–3 mm long; *peduncles* leaf-opposed and terminal to the main stem and (when present) some lateral branches, (1) 2–12 cm long; *spikes* racemiform, always laxly often remotely (5) 8–20-flowered, the flowers ascending on erect, hirsutulous pedicels 0.6–1.2 mm long, the glabrous axis becoming 3–20 (27) cm long, the flowers elevated well beyond the leafy parts of the stem; *bracts* broadly ovate-acuminate, spathaceous, submembranous, wrapped around the young flower-buds but thrown off long before anthesis, commonly livid or purplish about the obscure keel, brownish or pallid toward the margins, glabrous and gland-sprinkled dorsally, glabrous within, sometimes minutely puberulent at tip; *calyx* jointed to the pedicel, deciduous with the pod, 6.7–10 mm long, a little accrescent after early anthesis, hirsute with straight, lustrous, spiral hairs up to 1–1.8 mm long, the shallow tube 2.2–3 mm long, a little oblique at mouth, the ribs prominent, often purplish, the submembranous intervals charged with 3–5 uniseriate, orange or livid blister-glands, the narrowly lance-acuminate or -caudate, 1–2 (3)-spurred, plumose teeth unequal, the dorsal one longest, (3.7) 4–7.6 mm long, all ± stellate in age; *petals* concolorous or nearly so, commonly opening dull pinkish-purple or lavender, drying brownish or livid, rarely soft blue drying brown, all coarsely many-veined (the veins branching distally), the blade of the banner gland-sprinkled, those of wings and keel glandless (or the latter with a few small glands on blade, or one at apex, or both), the inner ones elevated only 0.5–1.5 mm above the hypanthium; *banner* 4.1–6.2 mm long, the claw (1.5) 1.8–2.5 mm, the spade-shaped, commonly acute blade open at base, 3–4.6 mm long, 2.8–4 mm wide; *wings* 5.1–6.6 mm long, the claw 1.5–2 mm, the obliquely ovate, obtuse blade 3.6–5 mm long, 2.2–3.6 mm wide; *keel* 7.3–11.3 mm long, the claws 2.6–3.3 mm, the broadly ovate-elliptic blades (4.8) 5.2–8.8 mm long, (3) 3.2–5 mm wide; *androecium* (6.6) 7.5–10 mm long, the longest filament free for (2.9) 3.2–4 mm, the bluish, gland-tipped anthers 1–1.35 mm long; *pod* harp-shaped, strongly compressed, 3–3.5 mm long, the style-base lateral or latero-terminal, the dorsal keel slender but distally prominent, the valves submembranous and glabrous proximally, papery and hirsute distally, charged with blister-glands arranged in 2 oblique crescents; *seed* ± 2.6 mm long; $2n = \pm 8_{II}$ (Mosquin). — Collections: 40 (xi).

Arid grassy flats, gullied knolls and barren, eroded hillsides, sometimes in crevices of cliffs or shelving rock-faces, 1410–2210 m (± 4700–7370 ft), on a variety of soils but mostly on gypsum and limestone, less often on mixed alluvia, volcanic ash, and perhaps other porous soils, local but widespread over the arid lands of the Mexican Plateau from Galeana district in the Sierra Madre Oriental, Nuevo León, to s.-e. Durango, s. to the Valley of Mexico (Estado and Distrito Federal), and through the desert valleys of Puebla and adjoining Morelos to n. and centr. Oaxaca. — Flowering May to October, and (southward) well into winter. — *Representative*: NUEVO LEÓN: *C. & M. Mueller 530* (F, GH, MEXU, TEX). SAN LUIS POTOSÍ: *Ripley & Barneby 13,296* (CAS, GH, K, MEXU, MICH, NY, UC, US). DURANGO: *Ripley & Barneby 14,163* (NY). AGUAS CALIENTES: *Rose & Painter 7706* (F, NY, US). GUANAJUATO:

Ripley & Barneby 13,379a (NY). HIDALGO: *Rose & Painter 7108, 8315* (NY, US). MÉXICO (D.F.): *Pringle 8522* (F, GH, M, MEXU, NY, UC, US, Z). MÉXICO (Edo.): *Rzedowski 16,791* (MEXU, TEX). MORELOS: *Ripley & Barneby 13,704* (CAS, NY, US). PUEBLA: *Purpus 1204* (F, NY, UC); *Ripley & Barneby 14,569* (CAS, NY, US). OAXACA: *Ripley & Barneby 13,655* (CAS, K, MEXU, MICH, NY, US), *14,659* (CAS, F, MEXU, MICH, NY, UC).

Dalea filiciformis (fern-shaped, presumably of the leaves, perhaps likened to the fronds of some *Pellaea*) Robins. & Greenm., Proc. Amer. Acad. **29**: 382. 1894. — "Collected upon limestone hills, Villar, San Luis Potosi [= Puerto de San José, a railroad halt on the Tampico line ± 50 mi n.-e. of San Luis Potosí], 14 September, 1893 (no. 5472)." — Holotypus, collected by C. G. Pringle, GH! — *Parosela filiciformis* (Robins. & Greenm.) Rose, Contrib. U. S. Nat. Herb. **8**: 303. 1905.

It seems almost superfluous to stress the unique facies of *D. filiciformis*, recognized on sight by the loose raceme of long-toothed, silvery-plumose calyces carried up on leaf-opposed peduncles well beyond the neat glaucescent foliage. The species has no really close relative in *Dalea* and its affinities are difficult to estimate. Rydberg placed it in his subgen. *Trichopodium* sect. *Calycosae*, next to the shrubby but yellow-flowered *Parosela berlandieri* (= *D. melantha* var. *berlandieri*) and *D. calycosa*, which is a species of *Marina*. These three have in common pedicelled flowers but little else. The detached flower of *D. filiciformis* resembles that of *D. formosa* and *D. purpusi* in the proportions and vesture of the calyx, but the nervature of the petals, the long pedicels, and the spathaceous bracts are very different. The harp-shaped pod of *D. filiciformis*, charged with two oblique crescents of blister-glands, recalls that of several species of *Marina*, from which it must be excluded, however, by the presence of two collateral ovules, leaflets lacking oblique lineoles, and hairs of the spiral, finally fulvescent type. The pedicelled flower combined with a sometimes frutescent habit and petals traversed by many thick, distally branching veins are suggestive of *Psorothamnus*, but the inner petals are elevated about the hypanthium on a definite even though short column, and neither bracts nor pod fit comfortably into the latter genus. Mosquin has found in one collection of *D. filiciformis* approximately 8 pairs or chromosomes, the number found in all members of sect. *Theodora*. Because of their dense spikes of finally nodding flowers these differ greatly in appearance. However, the spathaceous, submembranous, hairless bracts wrapped around the flower-buds of *D. filiciformis* are most nearly matched in the small sect. *Lachnostachyae* which are closely related, despite a basic chromosome number of seven, to eight-paired sect. *Theodora*. I suspect that these three groups, *Theodora, Lachnostachyae,* and *Psoropteris*, all of which are adapted to extremely xerophytic conditions that I have postulated as the primitive environment in which the ancestors of daleoid legumes differentiated, are related but primitive types of ancient lineage. The appearance in *D. filiciformis* of some characters suggestive of *Psorothamnus* and *Marina* supports the view that it is a primitive relic.

North of the Neovolcanic Belt *D. filiciformis* is encountered most commonly on gypsum-flats and on gullied gypseous hills and bajadas in the zone of arid grassland. It is not, however, the obligate gypsophyte, as suggested by Johnston (Jour. Arnold Arb. **22**: 159. 1942), for I have collected specimens from crevices of hard, crystalline limestone in the Sierra de Guadalcázar, San Luis Potosí, and on pebbly alluvia, possibly saline but not obviously gypseous, in Durango and Guanajuato. In Puebla and Oaxaca the species occurs on a variety of sedimentary and volcanic substrates, and appears equally at home on brushy hillsides, highway embankments, terraces of chalky volcanic ash, and basalt cliff-ledges, although always preferring open sites and most abundant in climax grassland.

The populations of the species found in the Valley of Mexico and northward are alike in being herbaceous or only feebly suffrutescent. Normally the stems arise anew each summer from the crown of a disproportionately thick taproot that may reach a diameter of

3 cm. Each stem gives rise to one or two, rarely more numerous, very long spikes that rise much beyond the leafy part of the plant and account for half or more of its total stature of 3–7 dm. The leaflets of main cauline leaves are 8–14 (exceptionally 17, not as described in the protolog, up to 37) pairs and the petals open rose- or lavender-purple, fading brownish or livid-purple. In Puebla, Morelos, and Oaxaca, the plants flower first as herbs but the stems persist or tend to do so and may ultimately form broomlike bushes with pliant but woody stems up to 2 m tall. With increased stature the leaflet number falls to about 7–10 pairs, the peduncles and racemes tend to be shorter, and the flowers become on the average a little smaller. Color of the petals is quite variable southward; perhaps most commonly pinkish striped with brown veins, but sometimes clear blue veined with blue of darker shades. Johnston (1941) thought the southern plant probably distinct from typical *D. filiciformis*, but the much more abundant material now at hand shows that the supposed differences are not firmly linked with each other or with patterns of dispersal.

Considering that *D. filiciformis* grew (at least formerly) as near to the heart of Mexico City as the castle hill at Chapultepec and the suburban village of Santa Fe, and was in fact first collected as early as 1791, somewhere in southern Mexico, by Tadeusz Hänke, it is remarkable that it remained undescribed until Pringle rediscovered it, in 1893, in San Luis Potosí. In any case I have been unable to identify it with any of several, as yet obscure species described during the XIX century and based on types that have been mislaid, lost, or destroyed.

II. Subgenus THEODORA Barneby

Annual and perennial herbs of small or low stature, from yellow or red roots; *leaflets* 2–7 pairs, mostly obovate or obcordate, usually conspicuously punctate beneath, the terminal one either sessile or stalked; *inflorescence* racemose, the flowers in bud ascending, at anthesis spreading, in fruit declined; *bracts* deciduous; *pedicels* subtended by and charged near apex with pairs of conspicuous orange or livid bracteolar glands; *calyx* pilose with long straight spiral hairs, the teeth aristiform from a deltate-triangular base, longer than the tube, finally spreading and plumose; *petals* (detached) of ± equal length or the banner longest, its blade oval to cordate-sagittate, not recessed at base into a cornet; *epistemonous petals* low-perching, charged near top of claw with 1–few glands, the blades of the keel narrowly imbricate and adherent by their exterior edges, enclosing the 10-merous androecium; *dorsal suture* of pod either filiform or dilated distally into a flat or 2-carinate prow; *pollen-grains* either prolate or dilated at either pole; x = 7 or 8. — Spp. 7, of the Mexican Plateau, Sonoran Desert, Chihuahuan Desert, and environs.

Dalea subgen. **Theodora** Barneby, subgen. nov. Flores conferte racemosi ad anthesin ac postea nutantes; pedicelli bracteolis 2 glanduliformibus obsiti; carinae laminae ipso basi glandulis 2 ornatae inter se imbricatim adhaerentes androecium totum tegentes; x = 8 vel 7. — Sp. typica; **Dalea mollis** Benth.

A group of seven species, different from all other daleas in the nodding, long-toothed calyces borne on prominently gland-bracteolate pedicels. Except for the narrow aristiform calyx-lobes and pubescence of long spiral hairs they resemble some species of *Marina*, and were first assembled by Rydberg (1929) under the collective epithet *Lachnostachydes* in his subgenus *Trichopodium*, otherwise with a few unimportant exceptions the equivalent of *Marina* as now received. The species of subgen. *Theodora* form two sharply distinct series: (i) sect. *Lachnostachyae*, characterized by enlarged spathaceous bracts similar in form to those of subgen. *Psoropteris*, an ovate banner-blade without descending basal lobes, a distally thickened style, and a pod with dorsal suture dilated under the style-base

so as to present, facing upward from the orifice of the fruiting calyx, a corneous or bicarinate prow; and (ii) sect. *Theodora*, differing in its narrow, plane bracts, cordate banner, filiform style, and undifferentiated pod. These two sections were found by Mosquin to differ further in chromosome number, the *Lachnostachyae* having the complement of seven pairs usual in *Dalea*, but *Theodora* eight pairs, a number unknown elsewhere in tribe *Amorpheae*. Striking peculiarities common to a few or only one species of sect. *Theodora* deserve comment: subacaulescent growth-form combined with externally glandless foliage in *D. verna*; marcescent keel-petals (but deciduous wings) in *D. verna* and *D. neo-mexicana*: and in several (Mahler, 1965, fig. 3, I, observed independently by Mosquin, unpubl.) an extraordinary, elongate pollen-grain dilated at either pole, entirely distinct from the prolate grain encountered elsewhere in *Dalea*. The importance of the pollen-differences is diminished, however by the fact that *D. mollis* and *D. mollissima*, which can be separated only with difficulty by coarser methods, have pollen of different types. A similar situation exists in the Acanthaceous genus *Stenandrium* Nees, in which phenotypically similar pairs of species are most reliably distinguished by morphology of the pollen.

The relationship of subgen. *Theodora* to the other branches of *Dalea*, or to other genera of daleoid Amorpheae, is difficult to interpret. Pedicelled flowers with glandiform bracteoles are common to subgen. *Theodora* and the genera *Psorothamnus* and *Marina* (in which $x = 10$), and a relatively ample vexillum undifferentiated at the claw is common to all *Psorothamnus*, most *Marina*, and those sections of *Dalea* which I believe, on other grounds, may be considered primitive in context of the genus. On the other hand, the long-aristate calyx-teeth of sect. *Theodora* are an advanced character, connected with wind dispersal of the seed. The modified pollen of some *Theodora* and the modified pod of sect. *Lachnostachyae* are certainly specialized. The eight pairs of chromosomes in *Theodora* could represent a relictual link in a hypothetical chain of aneuploid reductions leading from a primitive $x = 10$ surviving in *Marina* and $x = 7$ now apparently stabilized through most of *Dalea*; or alternatively as an independent aneuploid gain from the base of seven. The form of the pod in *Lachnostachyae* suggests, on the other hand, a connection, at first thought improbable, between subgen. *Theodora* and the yellow-flowered *Dalea* sect. *Cylipogon*, notable like *Lachnostachyae* for long-toothed (but sessile) calyces similarly clad in long, hispid hairs. In this connection it may be significant that *Cylipogon* and *Theodora* find their prime focus of diversity and numbers in the same arid region of northern Mexico, within and around the Chihuahuan Desert. The subgenus presents a challenging problem in plant phylogeny.

Subgenus *Theodora* is named in honor of Theodore Mosquin, whose cytological contributions have immeasurably advanced knowledge of *Dalea* and its tribal relatives.

Key to the Sections of Subgen. *Theodora*

1. Bracts plane or shallowly navicular only at base, not enfolding the flower-buds, narrowly or obscurely membranous-margined; *petals* only exceptionally blue, mostly whitish to ochroleucous, variously tinged or tipped with pink-purple or dull crimson, the banner-blade deltate-cordate, the apex ± acuminate, the basal sinuses deeply recessed; *hairs* of calyx up to 1–2.5 (2.7) mm long; *style* filiform; *dorsal suture* of pod not or only slightly thickened, never 2-carinate; $x = 8$.

II A. Sect. *Theodora* (p. 152)

1. Bracts spathaceous (flask-shaped, enfolding the flower-buds, when laid open 3–5 mm wide, broadly hyaline-margined; *petals* blue, the blade of banner ovate, at base rounded or very shallowly cordate, at apex obtuse; *hairs* of calyx very long, up to 2.7–4.5 mm; *style* clavately thickened distally; *dorsal suture* of pod greatly dilated under the style-base, corneous or 2-carinate; $x = 7$.

II B. Sect. *Lachnostachyae* (p. 163)

II A. Sectio THEODORA Barneby

Annual or perennial, from yellow or orange roots, the stems mostly diffuse or humifuse; *bracts* narrowly lance-acuminate, plane above immediate base, not folded around the flower-buds; *petals* mostly whitish tipped with lilac or dull crimson, sometimes yellowish, exceptionally blue; *blade* of banner deeply cordate at base, ± acuminate at apex; *prow* of pod filiform or somewhat dilated and cordlike, but not 2-carinate; x = 8. — Spp. 5, of the Sonoran and Chihuahuan deserts and n. Sierra Madre Occidental in n. Mexico and s.-w. United States, 1 extending s.-e. to centr. Tamaulipas.

Dalea subgen. **Theodora** sect. **Theodora** Barneby. *Dalea* subgen. *Theodora* Barneby, sect. typ. — Sp. typica: **D. mollis** Benth.

Key to the Species of Sect. *Theodora*

1. Flower relatively large, the keel-blades 4.2–5.9 mm long; w. margins of Mexican Plateau, s.-centr. Chihuahua to s.-centr. Zacatecas.
   2. Plant subacaulescent, the foliage forming rosettes, the peduncle solitary, terminal but appearing subscapose; *claws* of keel adnate to androecium in their lower half, not deciduous from a joint; *leaflets* not visibly gland-punctate beneath. 2. *D. verna.*
   2. Plant caulescent, the stems pliantly humifuse, the leaves separated by well-defined internodes, the peduncles both terminal and leaf-opposed; *claws* of keel deciduous, disjointing from pockets on the androecium; *leaflets* punctate around margins beneath. 3. *D. simulatrix.*
1. Flower smaller, the keel-blades 2.4–3.4 mm long; centr. Chihuahua e. across Coahuila to centr. Tamaulipas, n. into trans-Pecos (rarely into s.) Texas, w. to Gila Basin and widespread over the Sonoran Desert from s. Nevada to Baja California.
   3. Perennial herbs of arid grassland e.-ward from the e. margins of the Sonoran Desert in s.-e. Arizona and adjacent Sonora; *keel* marcescent, its claws adnate to the androecium, its blades undulately puckered along inner margin; *blade* of banner (2.8) 3–3.7 mm long. 4. *D. neo-mexicana.*
   3. Annual herbs of the Sonoran Desert (s. Nevada and s.-e. California to s.-w. Arizona, s. into coastal Sonora and Baja California); *keel* disjointing from the androecium, its blades plane; *blade* of banner 1.6–2.9 mm long.
      4. Calyx-tube 1.6–2.5 mm long; *keel* at anthesis as long or slightly longer than calyx-teeth; *wings* nearly always gland-tipped, the gland recessed into a subapical notch; *bracts* 0.7–1.1 mm wide; *margins* of leaflets plane or very obscurely gland-undulate; Baja California and Sonora, n. to Mohave County, Arizona and Coachella Valley, California. 5. *D. mollis.*
      4. Calyx-tube (2.5) 2.7–3.3 mm long; *keel* at anthesis much surpassed by calyx-teeth (caution: keel may be carried up beyond the teeth after disjointing); *wings* glandless, obtuse; *bracts* 1.1–1.6 mm wide; *margins* of leaflets undulately gland-crenate; Colorado and Mohave deserts, California to s. Nevada, w. Arizona, and extreme n. Sonora. 6. *D. mollissima.*

2. Dalea verna Barneby
(Plate XXX)

Loosely cespitose, subacaulescent and shortly caulescent perennial herbs from a slender tortuous rootstock, silky-hirsute throughout with spreading-ascending straight lustrous spiral hairs up to 1.2–2 mm long, the numerous stems up to 3 cm long, simple and densely leafy, the leaves loosely rosulate, the foliage aromatic when crushed but not visibly glandular, the leaflets gray-silky on both sides, not or very obscurely punctate beneath; *leaf-spurs* almost 0; *stipules* narrowly lanceolate, papery or early becoming so, 2–5 mm long, hirsute dorsally, brown and glabrous within, glandless; *intra-* and *post-petiolular glands* 0; *leaves* 2–5.5 (or at early anthesis only 0.5–1.5) cm long, petioled, the rachis obscurely margined, the leaflets (3) 5–7 pairs, broadly obovate to obovate-cuneate or oblong-obovate, 3–10 (12) mm long, concave ventrally, keeled dorsally, the sessile terminal one usually smaller than the rest; *peduncles* appearing subradical, incurved-ascending, (0.5) 1–2.5 cm long, shorter than to about as long as the leaves; *racemes* moderately dense, the flowers at first ascending, then horizontal, finally declined, when pressed ± 2 cm diam, the hirsute axis becoming 1–3 cm long; *bracts* deciduous, narrowly lance-acuminate, ± 5–7 mm long, at first thinly herbaceous, green or purplish, becoming dry and brownish, dorsally hirsute and sometimes minutely glandular, brown and glabrous within; *pedicels* 0.2–0.7 mm long, subtended by prickle-shaped glands up to 0.3 mm long; *calyx* (7.8) 8.5–10 mm long, barbately hirsute with lustrous hairs up to 2–2.7 mm long, the tube 3.2–3.5 mm long, not recessed behind banner, the ribs slender, livid, the plane pallid membranous intervals charged with 1 row of 2–5 tiny reddish glands, the deltate-aristiform gland-spurred teeth 4.5–6.8 mm long, plumose; *petals* bicolored, the banner whitish with green, early rubescent eye, the wings whitish or distally roseate, the keel brownish-crimson, all charged at base of blade but not at apex with small glands, the epistemonous ones inserted on the hypanthium rim but adnate through 1.2–2.2 mm to the androecium, not disjointing but marcescent, *banner* 5.6–5.8 mm long, the claw 2.6–2.7 mm, the sagittate-deltate, suberect blade 3.4–3.7 mm long, 2.9–3 mm wide, charged at base with transverse calluses but not recessed into a cornet; *wings* 6.3–6.7 mm long, the claw (including adnate part) 2.6–2.7 mm, the obliquely ovate or ovate-oblong, broadly auriculate blade 4–4.5 mm long, 2.1–2.2 mm wide; *keel* 7.7–10.2 mm long, the claws (including adnate part) 3.8–4.7 mm, the obliquely ovate blades 4.2–5.9 mm long, not puckered along interior margins, the exterior margins narrowly imbricate and adherent; *androecium* 10-merous, ± 8 mm long, the longer filaments free for ± 2.5 mm, the connective minutely gland-tipped, the pale yellow anthers 0.8–0.95 mm long; *ovary* densely pilose, the pod not seen. — Collections: 7 (4).

Open stony hills, gullied bluffs, and chalky breaks along stream-banks, on calcareous and metamorphic bedrock, 1650–2430 m (5500–8100 ft), forming colonies but highly localized, known from two restricted areas on the high grama-grasslands near the e. piedmont of Sierra Madre Occidental: n.-central Durango (mpos Villa Ocampo and nearby Villa Hidalgo) and s.-centr. Chihuahua (mpo Hidalgo del Parral); and w.-centr. Zacatecas (mpos Sombrerete and Saín Alto). — Flowering April and May, rarely again in fall. — *Material*: Chihuahua. Hidalgo del Parral: typus; *Mosquin 6919* (DAO, sterile, topotype). Durango. Villa Ocampo: 12.5 mi s.-e. of Villa Ocampo, *Ripley & Barneby 13,945* (NY, sterile). Villa Hidalgo: 30 mi s.-e. of Las

Nieves, *Mosquin 6919* (DAO, in part, mixed with *D. simulatrix*). ZACATECAS. Sombrerete: 2 mi e. of Sombrerete, *Ripley & Barneby 13,462* (CAS, NY); *Mahler 5746* (NY). Saín Alto: 3 mi s. of El Sauz, *Ripley & Barneby s. n. in 1965* (NY, sterile).

Dalea verna (of spring) Barneby, sp. nov. ex affinitate *D. neo-mexicanae* et *D. simulatricis*, illam carina unguibus cum androecio basi coalita marcescenti, hanc petalis majusculis simulans, sed ab ambabus caule abbreviato vel subnullo dense rosulatim foliato, pedunculo subscapiformi, necnon foliolis subeglandulosis facile separanda. *Dalea simulatrix* cum *D. verna* hinc inde sympatrica ab illa praeter caules evolutos tenellos procumbentes ideo habitu toto dissimilis ulterius differt petalis deciduis carinaeque lamina glandulis etiam supra basin conspersa. — Herbae humiles multicaules vel multicipites pilis sericeis nitidis undique laxe pilosae habitu adspectu inter affines singulares. — CHIHUAHUA. Hidalgo del Parral: open gravelly hills, ± 1930 m (5800 ft), 5 mi w. of Hidalgo del Parral, 3 oct 1965, *Ripley & Barneby 13,926*. — Holotypus, NY.

A remarkable dalea, not readily recognized as such when out of flower, distinct from all others in its cespitose, subacaulescent growth-habit. Mature plants at the type-locality form loose cushions of silvery-gray leaf-rosettes up to 3–4 dm diameter, suggesting a stemless *Astragalus* rather than a *Dalea*, for the foliage, although aromatic when crushed, is not obviously gland-punctate. Near Sombrerete it is possible, in September or October, to find growing with it no less than six species of the genus (*D. viridiflora, foliolosa, brachystachya, prostrata, laniceps, erythrorrhiza*), all still in flower or newly fruiting, but the plants of *D. verna* are barren. In northern Durango and adjoining Chihuahua *D. verna* is directly associated with the related *D. simulatrix*, which differs most obviously in its weakly humifuse stems radiating from the root-crown, bearing a succession of leaf-opposed racemes, but also more importantly in flower-structure. In *D. simulatrix* the wings and keel disjoint from pockets on the androecial column, as in the desert annuals *D. mollis* and *D. mollissima*, whereas in *D. verna*, as in *D. neo-mexicana*, the claws are adnate to the androecium and the blades persist in the form of a little papery sac. Nevertheless it seems probable that *D. verna* and *D. simulatrix* must be genetically compatible, for west of Parral, where they grow together, a plant (*Ripley & Barneby 13,926a*, NY) intermediate in stature and appearance was found to have the marcescent keel of *D. verna* combined with deciduous wings and gland-sprinkled petals of *D. simulatrix*. This plant must almost certainly be a hybrid. In Durango (s.-e. of Villa Ocampo) where the two species again occur abundantly in the same habitat no sign of introgression could be found.

The accompanying illustration was prepared from the holotype, a plant flowering atypically in the fall. Fine specimens collected recently by W. Mahler near Sombrerete in full flower in the first week of April show the vernal aspect of the plant, when the rosette leaves are still undeveloped and much surpassed by the silky-pilose cones of flower.

3. DALEA SIMULATRIX Barneby
(Plate XXX)

Slender humifuse perennial herbs with the habit of *D. neo-mexicana*, with several or numerous flexuous, simple or distally 1-branched, usually purplish and sparsely gland-tuberculate stems (1) 1.5–2.5 dm long radiating from an eventually woody root, softly and densely villosulous throughout with fine, spreading and widely ascending hairs, the foliage ashen, the leaflets equally pubescent both sides, punctate beneath and marginally, their margins commonly somewhat undulate; *leaf-spurs* almost 0; *stipules* thinly herbaceous, lanceolate or subulate, 1–2.5 mm long, villous and glandular dorsally; *intrapetiolular glands* 0; *post-petiolular* glands prominent, obtuse, pale yellow, often situated not precisely behind the petiolule; *leaves* shortly petioled,

(0.6) 1–2 cm long, with very narrowly margined rachis and (3) 4–7 pairs of obovate, oblong-obovate, or obovate-cuneate, apically rounded or emarginate, loosely folded or navicular, dorsally keeled leaflets 2–7 mm long, the terminal one sessile and smaller than the last pair; *peduncles* mostly terminal, or 1 terminal and 1 leaf-opposed, 2–4.5 cm long; *racemes* dense, ovoid becoming oblong, when pressed at full anthesis 16–19 mm diam, the villosulous axis becoming 1.5–4.5 cm long; *bracts* deciduous, narrowly ovate- to lance-acuminate, thinly herbaceous becoming papery, 4–5.5 mm long, 0.7–2 mm wide, ± navicular, densely villosulous and charged with a few glands dorsally, glabrous within; *pedicels* 0.2–0.5 mm long, the prickle-glands at base and apex 0.3–0.5 mm long, livid; *calyx* 6.8–8.5 mm long, densely silky-pilose with spreading-ascending spiral hairs up to 1.6–2.7 mm long, the tube 3.1–3.5 mm long, not recessed behind banner, the ribs slender, prominulous, livid or pinkish, the membranous intervals charged with 1 row of (1) 3–5 small orange glands, the deltate-aristate, finally spreading and long-plumose teeth 3.7–5.3 mm long; *petals* ± bicolored, whitish with inner half of wings and keel-tip pink-purple, all gland-sprinkled, the epistemonous ones perched well below middle of androecium and all deciduous; *banner* 6.3–7.3 mm long, the claw 2.7–3.5 mm, the deltate-cordate blade 4–4.7 mm long, 4–4.4 mm wide; *wings* 6–7.1 mm long, the claw 1.5–1.9 mm, the lance-ovate blade 4.5–5.3 mm long, 1.8–2.6 mm wide; *keel* (6) 6.2–7.5 mm long, the claws 2–2.5 mm, the obliquely obovate blades 4.2–5.2 mm long, 2.5–3.2 mm wide, the inner margins undulately puckered; *androecium* 10-merous, 7.3–8.5 mm long, the longer filaments free for 2.2–2.6 mm, the connective gland-tipped, the anthers 0.8–1 mm long; *pod* obovoid, strongly compressed, ± 3 mm long, the style-base obliquely terminal, the prow thickened, narrowly bicarinate, the valves hyaline in lower ⅓, thinly pilose and papery distally; *seed* ± 2.3 mm long; 2n = 16 (Mosquin). — Collections: 4 (ii).

Open calcareous gravel hills and gravelly or chalky gullied bluffs in arid grassland, sometimes with juniper, ± 1750 m (5800–5850 ft), local but forming colonies, in all known stations associated with *D. verna*, on the e. piedmont of Sierra Madre Occidental in s.-centr. Chihuahua (mpo Hidalgo del Parral) and adjoining Durango (mpos Villa Ocampo and Villa Hidalgo). — Flowering September to November, probably again in spring. — *Material*: CHIHUAHUA. Hidalgo del Parral: 5 mi w. of Parral, *Mosquin 6920* (NY), *Ripley & Barneby 13,927* (CAS, NY, US). DURANGO. Villa Ocampo: cf. typus; Villa Hidalgo: 30 mi s.-e. of Las Nieves, *Mosquin 6916* (DAO, p.p., mixed with *D. verna*).

Dalea simulatrix (aping *D. neo-mexicana*) Barneby, sp. nov., *D. neo-mexicanae* Gray affinis, praesertim floris majusculi carina decidua nec marcescenti, carinae laminis majoribus 4.2–5.2 (nec 2.4–3.4) mm longis absimilis. — DURANGO; gravelly and chalky bluffs along stream, with junipers, in rolling grassland, 1755 m, ± 18 km (12.5 mi) s.-e. of Villa Ocampo, oct 4, 1965, *Ripley & Barneby 13,944*. — Holotypus, NY.

This local species may be visualized as a large-flowered version of *D. neo-mexicana*, to which it is obviously closely akin. It would have been subordinated to *D. neo-mexicana* as a fourth variety except for the fact that the keel as well as the wings disjoint from pockets on the androecium. In this feature it resembles *D. mollis* and *D. mollissima*, but is perennial and native to the cool dry highlands at the east foot of Sierra Madre Occidental, not the torrid lowlands of the Sonoran Desert. A minor differential character is found in the epistemonous petals. the blades of which are sprinkled with glands well above the base. The known ranges of *D. neo-mexicana* var. *neo-mexicana* and *D. simulatrix* are separated by a discontinuity along the foot of the Sierra equal to a degree of latitude. The less similar *D. neo-mexicana* var. *megaladenia* is found a similar distance eastward in the same latitudes but out on the floor of the Chihuahuan Desert. A supposed hybrid between *D. simulatrix* and its compatriot *D. verna* is mentioned under the latter species.

4. Dalea neo-mexicana Gray
(Plates XXXI and XXXII)

Slender, diffuse or prostrate, loosely tufted or matted herbs from a yellow perennial root, sometimes flowering precociously and then appearing annual, ± densely silky-pilosulous with widely spreading or subretrorse, straight spiral hairs up to 0.6–1.7 (2) mm long, the several or numerous pliantly humifuse or weakly and flexuously assurgent, sparsely or densely orange- or livid-pustulate stems (2) 3–35 cm long, simple or branched distally, when short monocephalous, when longer bearing 1–several leaf-opposed inflorescences, the foliage gray-silky or less often green, equally pubescent on both sides or glabrate above, the leaflets charged beneath with a row of large glands parallel and approximate to the margins and 1–2 rows parallel to the midrib, and dorsally just below apex with a single larger gland; *leaf-spurs* 0.4–1.5 mm long; *stipules* thinly herbaceous becoming stramineous, narrowly triangular-subulate to lance-acuminate, 0.6–1.8 (2.4) mm long, pilosulous and often gland-pustulate dorsally; *post-petiolular glands* prominent, livid or orange, often scattered on the rachis (not exactly behind the petiolule); *leaves* at least shortly petioled, 0.8–4.5 cm long, with narrowly margined rachis and (3) 4–7 pairs of obovate to obovate-oblong or cuneate-obcordate, obtuse, truncate-emarginate, or widely and openly retuse, flat or loosely folded leaflets 2.5–8 mm long, the margins either plane or strongly undulate-crenulate, the lowest and uppermost leaflets usually smaller than the rest, the leaf-outline therefore ± oval-elliptic; *peduncles* slender, incurved-ascending, 3–40 mm long, bringing the raceme to vertical or almost so; *racemes* moderately dense, ovoid becoming oblong, the flowers ascending in bud, early spreading, at least the lowest nodding in age, at full anthesis (pressed) 1.3–1.6 (1.8) cm diam, the pilosulous axis 1–6 cm long; *bracts* early deciduous, lance-acuminate or -caudate, (3) 3.5–6 mm long, thinly herbaceous becoming papery, greenish or commonly livid-purpurascent, dorsally pilosulous and glandular; *pedicels* 0.3–0.6 (0.7) mm long, subtended by and charged near apex with a pair of prickle-shaped or mammiform, livid or nigrescent glands 0.2–0.7 mm long; *calyx* 4.7–8 (8.8) mm long, densely pilose with fine spreading spiral hairs up to (1.2) 1.5–2.2 (2.6) mm long, the tube 2.1–3.1 mm long, the ribs firm but slender, the hyaline intervals charged with 1 (sometimes irregular) row of ± 5–7 (9) small, often orange, sometimes transparent glands, the teeth aristiform from a deltate or broadly triangular base, 2.5–5.7 mm long, in age plumose; *petals* usually bicolored, the eye of the whitish (yellowish) banner green turning, like the keel-blades, dull crimson, the rest varying from whitish to pale straw-yellow and variably pinkish-tipped, none gland-tipped but all charged near base with a few small glands, the wings perched below middle of androecium and disjointing from it, the keel-claws continuous from hypanthium but adnate nearly to middle of androecial tube, marcescent; *banner* 4–5.6 mm long, the claw 1.4–2.6 mm, the deltate, acute or subacute, rarely minutely emarginate, basally cordate sagittate blade (2.8) 3–3.7 mm long, 2.3–3.4 mm wide; *wings* (measured from joint) 3.3–4.2 mm long, the claw 0.7–1.2 (1.5) mm, the obliquely ovate blade broadest near middle, narrowed but obtuse distally, 2.4–3.3 mm long, 1.3–1.8 mm wide; *keel* (measured from hypanthium rim) 4.5–7.1 (7.5) mm long, the claws (half adnate) 2–4.2 mm long, the obliquely obovate, puckered blades 2.4–3.2 mm long, 1.8–2.2 (3) mm wide; *androecium* 10-merous, 5–6.7 (7.2) mm long, the longer filaments free for 1.3–2.4 mm, the connective minutely gland-tipped or glandless, the anthers 0.5–0.7 (1) mm long; *pod* 2.3–3 mm long, in profile obliquely obovate, the style-base lateral just below apex, the valves hyaline in lower ½–⅔, thence thinly papery, pilose, eglandular, the prow ± thickened, cordlike, glabrate; *seed* brown, lustrous, 1.7–2.4 mm long.

As defined by the foregoing description, *D. neo-mexicana* is a complex species composed of at least three subsidiary taxa, the status of which is open to controversy. They are treated herein as geographic expressions of one specific type because, although sharply characterized at the middle of their ranges, they seem not to be separated by any decisive discontinuity, morphological or edaphic. The feature that brings them together is the marcescent keel, shared only by the related but subacaulescent *D. verna*, a species that differs in having wings as well as keel marcescent, larger flowers, and apparently glandless foliage. In general appearance *D. neo-mexicana* resembles *D. mollis* and *D. mollissima*, but these are annuals confined to the floor of the Sonoran Desert, with epistemonous petals all deciduous from pockets on the androecium, in normal *Dalea* fashion. West of the Continental Divide *D. neo-mexicana* is found in hill-country above the highest contour of the Sonoran Desert as delimited by Shreve & Wiggins (1964), entering true desert country east of Sierra Madre in the form of var. *megaldenia*, endemic to the region of Bolsón de Mapimí. The differential characters of the also related and similar *D. simulatrix* are mentioned under that heading.

I retain Gray's original spelling of the epithet *neo-mexicana*, unusual, it is true, but not to be corrected for that reason.

Key to the Varieties of *Dalea neo-mexicana*

1. Mammiform glands on pedicel small, up to 0.15–0.4 mm long; *calyx* teeth long, the dorsal one (3.4) 3.8–5.7 mm (exceptionally less than 3.5 mm) long; *glands* in intervals of calyx small but nearly always prominent, visible externally as shining resinous points among the hairs; *leaflets* pubescent both sides; range of the species (centr. Tamaulipas to Arizona, Texas, and n.-e. Durango).
   2. Leaflets cuneate-obcordate, usually strongly undulate by impression of the large submarginal glands, these up to 0.2–0.3 mm diam; trans-Pecos Texas and w.-centr. Coahuila to s. Arizona and n. Sonora, locally disjunct in lower Rio Grande valley in s. Texas. 4a. var. *neo-mexicana*.
   2. Leaflets obovate or elliptic-obovate, obtuse or shallowly emarginate but not obcordate, the margins plane, the submarginal glands smaller, up to 0.1–0.2 mm diam; s. and e. Coahuila e. to centr. Tamaulipas, n. locally into lower Pecos valley in Texas. 4b. var. *longipila*.
1. Mammiform glands on pedicel large, very conspicuous (as in *D. lachnostachya*), up to 0.5–0.7 mm long; *calyx-teeth* 2.5–3.3 (3.5) mm long; *glands* in intervals of calyx very small, often almost colorless and invisible or almost so from without; *leaflets* above glabrous or thinly pilosulous marginally, deltate-obcordate and gland-undulate as in var. *neo-mexicana*; local in w.-centr. Coahuila and adjoining Chihuahua and n.-e. Durango. 4c. var. *megaladenia*.

4a. Dalea neo-mexicana (Gray) Cory var. neo-mexicana (Plate XXXI)

Stems mostly 3–20 cm long, simple or 1–2-branched; *foliage* gray-silky, the leaflets pubescent above and beneath; *leaves* 0.8–2.5 (3.2) cm long, the cuneate-obcordate leaflets strongly gland-undulate; *peduncles* 0.3–3.5 cm long; *calyx* mostly 6.6–8 mm long, the tube 2.4–3.1 mm, the teeth (3.4) 3.8–5.2 (5.7) mm long; *petals* usually whitish variegated with dull crumson, rarely yellowish; 2n = 16 (Mosquin); n = 8 (Spellenberg, 1973). — Collections: 49 (i).

Stony hills, knolls, and washes, in arid grassland transitional to desert, on a variety of sedimentary and volcanic substrates, rarely on gypsum, mostly 700–1750 m (2100

–5300 ft), local but sometimes abundant, scattered over the northern Chihuahuan Desert from near 27° 30′ N, n.-w. Coahuila and e. Chihuahua n.-ward from middle Conchos valley, and across Rio Grande (Bravo) into s. and w. trans-Pecos Texas (Brewster, Presidio, Hudspeth cos., n. to the Glass Mts.); unknown as yet from n. Chihuahua but reappearing near the Continental Divide in s.-w. New Mexico (Grant and Hidalgo cos.), thence w. to the edge of the Gila Basin in s.-e. Arizona (Cochise, e. Pima, Santa Cruz cos.) and s. to the headwaters of Ríos Magdalena and Sonora in n.-e. Sonora; disjunct (and atypical; cf. discussion infra) on low hills along the Rio Grande, at ± 180 m, in Webb County, Texas. — Flowering April to June, August to November. — *Representative*: UNITED STATES. ARIZONA: *Peebles & Harrison 6940* (NY); *Maguire 11,229* (NY); *Peebles & Loomis 6995* (NY). NEW MEXICO: *Maguire 11,414* (NY). TEXAS: *Warnock 13,838* (RENNER); *Hinckley 649, 1282, 2778* (NY); *Moore & Steyermark 1065* (NY, UC); *Correll 20,660, 33,833* (RENNER). MEXICO. SONORA: *Gentry 17,599* (US); *Mahler 6089* (NY). CHIHUAHUA: *Stewart & Johnston 2017* (GH, TEX); *Johnston & Mueller 100,* (MICH, TEX); *Mosquin 6569* (NY); *Ripley & Barneby 13,893* (NY). COAHUILA: *Johnston & Mueller 1009* (MICH, TEX); *Stewart 1748* (GH); *Johnston 1814* (GH).

Dalea neo-mexicana (Gray) Cory, Rhodora **38**: 406. 1936, based on *D. mollis* var. ? *neo-mexicana* (of New Mexico, although described from Texas) Gray, Pl. Wright. **1**: 47. 1852 (*"Neo-Mexicana"*). — "127...Hills beyond the Pecos, and the Pass of the Limpia; Aug." — Holotypus, collected by Charles Wright in 1849, GH! isotypi, NY, UC! — *Parosela neo-mexicana* (Gray) A. Heller, Cat. N. Amer. Pl. ed 2, 6. 1900. *P. mollis* var *neo-mexicana* (Gray) Macbr., Contrib. Gray Herb., New Ser. **65**: 16. 1922.

A modest little plant, but attractive because of its neatly crimped leaflets and lustrously silky racemes of calyces. In dry springs the plants may flower when the stems, all monocephalous, are only a few centimeters long, but following summer rain the mats of foliage can attain a diameter of 4 decimeters, each primary stem giving rise beyond the middle to one or two leaf-opposed peduncles or branchlets. The petals, all included within the plumose calyx-teeth, vary in color. They are commonly whitish tinged or tipped with dull crimson, but on gypseous soils in Coahuila Johnston noted them as "violet" or "yellowish" (*I. Johnston 2017, 9371*, GH), the last suggesting passage to var. *megaladenia*, also gypsophilous. The known range of var. *neo-mexicana* is twice interrupted. There is no record from the basin of Lagunas Guzmán-Santa María in northwest Chihuahua, but the species is to be expected around its western periphery, for the populations in New Mexico and Arizona are indistinguishable from those in trans-Pecos Texas, and there are suitable habitats available the length of the Sierra Madre piedmont. The outlying station on lower Rio Grande in Webb County, Texas (12 mi n.-w. of Laredo, *McCart 8386*, OKLA) documents a more serious and perhaps racially significant disjunction. The one collection studied resembles var. *neo-mexicana* of trans-Pecos in habit and size of glands upon and subtending the calyx, but the calyx-teeth are only 3–3.5 mm long, as in var. *megaladenia*. The form of *D. neo-mexicana* that would be expected at low elevations in southern Texas is var. *longipila*, found only a short distance south of the border in Nuevo León, but the crisply undulate leaflets and short calyx-teeth of the Laredo plant are decisively different. More material is required before the status of this form can be settled.

4b. DALEA NEO-MEXICANA (Gray) Cory var. LONGIPILA (Rydberg) Barneby (Plate XXXI)

Habit of var. *neo-mexicana*, but the leaflets obovate (not obcordate), charged dorsally with small glands (cf. key to varieties), the margins plane; *inflorescence* and flower essentially as var. *neo-mexicana*. — Collections: 23 (iii).

Stony hillsides and sandy clay knolls in the foothills of desert mountains, sometimes on gypseous shale, most often on linestone, 340–1800 m (1130–5400 ft), local and (as known) apparently discontinuous, frequent in s.-e. quarter of Coahuila (mpos Parras to Cuatro Ciénegas, Monclova, Saltillo) and adjoining n.-w. Nuevo León (Sabinas Hidalgo to Monterrey), s. (habitat not recorded) along e. piedmont of Sierra Madre to centr. Tamaulipas (Cd. Victoria); apparently disjunctly on limestone hills along and immediately n. of Rio Grande upstream from mouth of Pecos River into e. Brewster County, Texas, to be expected in n.-e. Coahuila. — Flowering March to June, August to November. — *Representative:* UNITED STATES. TEXAS: *Correll & Johnston 19,334* (RENNER); *Turner & Warnock 2050* (TEX). MEXICO. COAHUILA: *Palmer 16 in 1898* (F, NY, UC); *Ripley & Barneby 13,276* (MEXU, NY, US); *Purpus 1066* (F, NY, UC); *Ripley 14,942* (NY); *Johnston 8731* (GH, TEX). NUEVO LEÓN: *Warnock & Barkley 14827M* (F, TEX); *Ripley & Barneby 13,804* (CAS, NY). TAMAULIPAS: *Palmer 519* (NY).

Dalea neo-mexicana (Gray) Cory var. **longipila** (Rydb.) Barneby, stat. nov., based on *Parosela longipila* (long-haired) Rydb., N. Amer. Fl. **24**: 64. 1919. — "Type collected in western Texas, October, 1849, *Wright 126...*" — Holotypus, GH! — *Dalea longipila* (Rydb.) Cory, Rhodora **38**: 406. 1936. *D. mollis* var. *longipila* B. L. Robins. ex Rydb., l. c. in syn.

In almost all respects like var. *neo-mexicana*, but readily recognized in practice by the plane, obovate, emarginate but not widely notched leaflets charged on the back with smaller glands. The difference in leaflets is of the same order as between *D. mollis* and *D. mollissima* on the Sonoran Desert, but these differ further in shape of bracts and wing-petals, and moreover are broadly sympatric, whereas vars. *neo-mexicana* and *longipila* have essentially identical flowers and are vicariant, their ranges contiguous in trans-Pecos Texas (Brewster County) but separated in northern Mexico by that of var. *megaladenia* in the low deserts around and related to Bolsón de Mapimí. Despite the epithet, the vesture of var. *longipila* is not uniformly longer, and slight differences in the shape of petals noted by Rydberg (in key, 1919, p. 50) have not been confirmed in recent collections. If emphasis is shifted from the one palpable difference to the multiple similarities it becomes reasonable to treat *D. neo-mexicana* and *D. longipila* as aspects of one marked specific type.

The epithet *longipila* having been used by Robinson only in annotation, and that in a context remote from that in which was published, it is attributed here solely to Rydberg.

4c. DALEA NEO-MEXICANA (Gray) Cory var. MEGALADENIA Barneby (Plate XXXII)

Often more robust than var. *neo-mexicana*, the stems up to 3.5 dm long; *leaves* 2–4.5 cm long, the leaflets shaped and marginally undulate as in var. *neo-mexicana* but glabrous or nearly so above; *peduncles* 1–4 cm, and raceme-axis 2–6 cm long; *calyx* 4.7–6.9 mm, its tube 2.1–2.5 mm, and teeth 2.5–4.4 mm long; *petals* ochroleucous or stramineous sometimes lilac-tipped, rarely blue; 2n = 16 (Mosquin). — Collections: 17 (i).

Sandy and gravelly flats, dry rubbly hillsides, on limestone and gypsum, sometimes on dunes, 1100–1270 m (3650–4230 ft), locally abundant but confined to interior desert basins of w. Coahuila between lat. 26° 30′ and 28° 30′ N, s.-w. around the s. margin of Bolsón de Mapimí into convergent corners of Chihuahua (mpo Jiménez) and Durango (mpo Gómez Palacio), there reaching s. to 25° 40′, and n.-w. just into the corner of Chihuahua below the Big Bend of Río Bravo (mpo Manuel Benavides) at nearly 29° N. — Flowering June to November, following rains. — *Representative*: CHIHUAHUA: s.-e. of San Carlos, road to Providencia, *Johnston & Mueller 101* (MICH,

TEX); n.-w. of Escalón, *Correll & Johnston 21,453* (RENNER). COAHUILA: w. of Castillón, *R. M. Stewart 555* (GH); Matrimonio to Americanos, *I. Johnston 9374* (GH, TEX); Llano de Guaje, *R. M. Stewart 1150* (GH); s.-e. of San José on road to San Antonio de los Alamos via Zenzontle, *Johnston & Mueller 976* (MICH, TEX); Mohovano, *Purpus 4484* (F, UC); s. of Est. S. Fernando, toward Sa. Mojada, *M. C. Johnston et al. 10861* (NY); n. end of Bolsón de los Lipanes, *Johnston & Mueller 1237* (TEX); Sa. de los Remedios n.-e. of Tlahualilo, *Henrickson 12188* (TEX). DURANGO: base of Sa. de Mapimí near Dinamita, *Ripley & Barneby 14,207* (CAS, DAO, GH, MEXU, MICH, NY, US).

Dalea neo-mexicana (Gray) Cory var. **megaladenia** (with large glands) Barneby, var. nov., a var. *neo-mexicana* quoad foliorum ambitu cuneato-obcordato marginibus undulatis similis sed foliolis superne glabris vel ad marginem parce pilosulis, glandulis pedicellum fulcrantibus maximis (ad 0.5–0.7 mm usque longis), calycisque dentibus saepissime brevioribus (dorsali 2.5–4.4 mm longo) abstans. — COAHUILA: sand hills on road from Guimbalete s.-e. to Acatita via Laguna del Rey, sept 17, 1942, coll. Reynaldo Santos under direction of Robert M. Stewart, distrib. *Stewart 2646*. — Holotypus, GH; isotypus (fragm), NY.

The material listed as var. *megaladenia* is somewhat heterogeneous in detail, but differs collectively from var. *neo-mexicana* in the green or glaucescent foliage, the leaflets glabrous or only marginally pubescent above, in the massive glands at base and apex of the pedicels, and in the relatively short calyx-teeth. In general the plants are coarser than the average var. *neo-mexicana*, with larger leaves and longer, somewhat looser racemes. The petals vary in color, according to different collectors "blue" (the type), "light lemon" or "yellow" (Stewart), or as seen in northeast Durango ochroleucous faintly tipped or tinged with dull pinkish lilac. Because of the thin pubescence combined with large glands and sometimes blue petals, I suspected at first that the entity represented a series of hybrids involving *D. neo-mexicana* and *D. lachnostachya*, the ranges of which coincide about the edge of that of var. *megaladenia*. But where the two species are sympatric and even closely associated in parts of trans-Pecos Texas no hybrids have ever been seen. It seems entirely more likely that *D. neo-mexicana* has given rise under the extremely severe conditions of the bolsón region in the Chihuahuan Desert to a series of modified populations not yet stabilized or uniform nor, probably, detached genetically from the parental stock. A collection from gypsum in the Conchos valley in the latitude of Ciudad Chihuahua (*Johnston 8300*, GH) which I have referred to var. *neo-mexicana* has relatively large glands in the inflorescence; and another population on the Rio Grande in Webb County, Texas, already mentioned particularly under var. *neo-mexicana*, has with the vesture of the latter the short calyx-teeth of var. *megaladenia*.

5. DALEA MOLLIS Bentham
(Plate XXXIII)

Annuals, germinating either in fall or winter, often flowering precociously when only 3–10 cm tall, but when the season permits with an ultimately lignescent, orange root and numerous, radiating, prostrate or distally incurved, simple or branched, stramineous but prominently gland-tuberculate stems up to 1–3.5 (6.5) dm long, pilose-pilosulous throughout or nearly so with fine, divergent or loosely ascending hairs up to (0.4) 0.5–1.1 (1.3) mm long, the foliage glaucescent, the leaflets equally pubescent on both sides or glabrate above, grossly livid-pustulate beneath, the vesture of the silky-barbate inflorescence commonly tarnishing when dry, that of the leaves

usually unchanged; *leaf-spurs* 0.5–1.5 mm long; *stipules* subulate, lanceolate, or lance-caudate, (0.6) 1–2.5 mm long, thinly herbaceous becoming stramineous, pubescent dorsally and charged with one or more large glands; *intrapetiolular glands* 0; *post-petiolar* glands large, orange or livid, prominent, and often ± scattered and not directly opposed to the petiolule; *leaves* (0.5) 1–3.5 cm long, slenderly petioled, with (3) 4–6 (7) pairs of obovate, obcordate, cuneate-obcordate, suborbicular, or oblong-obovate, deeply notched to subemarginate, loosely folded leaflets (2) 3–8 cm long, their margins plane, neither toothed nor undulate; *peduncles* mostly leaf-opposed, in some dwarf plants terminal and solitary, 0.2–2.5 (4.5) cm long; *racemes* densely many-flowered, ovate in outline early becoming oblong or narrowly cylindric, 8–14 mm diam, the flowers spreading in early anthesis, then declined and loosely retrorse-imbricate in fruit, the pilosulous axis (0.5) 1–3.5 cm long; *bracts* lance- or elliptic-acuminate or -caudate, (3) 4.5–8 mm long, thinly herbaceous, green or purplish, glandular and pilose dorsally, glabrous within, gland-tipped; *pedicels* 0.3–0.6 mm long, the black or livid, prickle-shaped glands at base and toward apex (0.3) 0.4–1 mm long; *calyx* 3.3–6.6 mm long, silky-barbate with ascending, straight, spiral hairs up to 1–1.8 mm long, the tube 1.6–2.5 mm long, the orifice symmetric, the ribs sub-filiform, commonly castaneous, the hyaline intervals charged with one row of (1) 2–6 small orange glands, the teeth deltate- or triangular-aristate, of about equal length, (2.5) 2.7–4 mm long, nearly always gland-spurred; *petals* whitish, but the keel-tip and sometimes the blade of the banner tinged with lilac or dull crimson, the banner gland-sprinkled in the hyaline eye, the wing- and keel-blades charged with a few glands at base, the wings gland-tipped, the inner petals raised ± 0.9–1.4 mm above the hypanthium rim; *banner* 3–4.2 mm long, the claw 1.2–2.1 mm, the deltate-, ovate- or sub-orbicular-cordate, subacute to emarginate blade (1.5) 1.7–2.9 mm long, 2.2–3.2 mm wide; *wings* 2.9–4.3 mm long, the claw 0.9–1.4 mm, the ovate-oblong blade obliquely notched at apex, 2.1–3 mm long, 1.1–1.4 mm wide; *keel* 3.4–4.5 mm long, the claws 1–1.6 mm long, the half-obovate blades 2.3–3.4 mm long, 1.4–2 mm wide; *androecium* 10-merous, 3.5–5.7 mm long, the longest filament free for 1.2–2 mm, the gland-tipped anthers 0.4–0.6 mm long; *pod* obliquely obovoid, 2.2–2.7 mm long, the style terminal but excentric, the submembranous valves transparent in the lower ⅔, distally opaque, minutely gland-sprinkled and pilosulous, the keels filiform; *seed* pale-brown, lustrous, ± 1.8–2.2 mm long; 2n = 16 (Mosquin); n = 8 (Spellenberg, 1973). — Collections: 106 (v).

Sandy and gravelly washes, bajadas, sometimes on dunes, mostly below 700 m (2300 ft), around Salton Sea descending to —50 m, reportedly reaching 1200 m in Sierra Borja in Baja California, widespread and common over the floor of the Sonoran Desert from s.-e. Mohave Desert in San Bernardino County and Coachella Valley, Riverside County, California, to the valley of the Colorado and lower Gila rivers in s.-w. Arizona, s. in Sonora to the latitude of Guaymas, and through the islands of the Gulf of California and the deserts of Baja California to the Llanos de Magdalena and Bahía de La Paz, lat. 24° 12′ N., reaching the Pacific coast at Isla Cedros and at Isla Sta. Margarita on Bahía Magdalena. — Flowering January to May. — *Representative*: UNITED STATES. CALIFORNIA: *Jepson 15,479* (JEPS); *Eastwood 3058* (CAS, NY); *E. K. Balls 12,961* (DAO, POM). ARIZONA: *Jones 4431* (NY, POM); *A. & R. Nelson 11,135a* (NY, UC). MEXICO. SONORA: *Shreve 5827, 5842* (ARIZ, US); *Ripley 14,316* (ARIZ, CAS, NY); *Mason, Turner & Hastings 1836* (ARIZ, MEXU). BAJA CALIFORNIA (Norte): *Johnston 4235* (F, NY, UC); *Wiggins 5359* (NY, UC); *Palmer 512* (NY); *Moran 8065* (SD). BAJA CALIFORNIA (Sur): *Gentry 7362, 7460, 7538* (ARIZ, UC); *Wiggins 5457* (NY, UC), *7937* (F, UC); *Carter 2745* (UC).

Dalea mollis (soft) Benth., Pl. Hartw. 306. 1848. — "In vicinibus Monterey legit Coulter." — Holotypus, collected probably in or near the Yuma Desert, in extreme s.-e. California or adjoining Arizona, in 1832, K (herb. Benth.)! isotypus (*Coulter 430*), GH! — *Parosela mollis* (Benth.) A. Heller, Cat. N. Amer. Pl., ed. 2, 6. 1900.

Parosela pilosa Rydb., N. Amer. Fl. **24**: 64. 1919. — "Type collected at Los Angeles Bay, Lower California, 1887, *Palmer 550*..." — Holotypus, NY! isotypi, GH, US! — *Dalea mollis* subsp. *pilosa* (Rydb.) Wiggins, Contrib. Dudl. Herb. **3**: 51. 1940.

Except in a small area lying between the Colorado River delta and Sierra Juárez, *D. mollis* is the only species of its type found on the true deserts of Sonora, Baja California, and the islands in the Gulf of California. From the delta north through the Colorado Desert and the lower Colorado valley in Arizona it is sympatric and sometimes directly associated with the related and similar *D. mollissima*. Both species vary greatly in stature, often starting precociously into flower when only a few centimeters tall, yet capable, if the rains come with appropriate timing and volume, of forming leafy mats, up to 5–8 (rarely 13) dm in diameter, of radiating, branched stems which bear an indefinite succession of leaf-opposed racemes until growth is halted by heat of summer. The orange root, at first filiform or nearly so, can attain a girth of a centimeter or more, but although eventually tough and woody rarely or never persists into a second year. The glaucous, finely pilose leaves, dotted beneath like the stramineous stems with prominent livid glands, and the dense spikes of nodding, silky-barbate calyces, distinguish *D. mollis* and *D. mollissima* collectively from all species except *D. neo-mexicana*, the differential characters of which have been stressed above.

Rydberg (1919, p. 50, in clave) and Wiggins (1940, p. 51–52, Pl. X, XI) have brought out the main differences between *D. mollis* and *D. mollissima*, characters repeated, with some change of emphasis, in the foregoing sectional key. In general *D. mollis* is the more slender of the pair, but its spike varies in thickness with the varying length of the calyx-teeth, and at its largest mimics the always thick-spiked *D. mollissima*; but even here the *tube* of the calyx remains absolutely shorter, and the androecium is longer relative to the calyx-teeth. The vesture of the foliage in *D. mollis* tends to remain silvery in the herbarium, although that of the spike tarnishes quickly after drying; in *D. mollissima* the hairs of leaf and calyx alike turn golden or yellowish after a few months in the herbarium. In their common range the two species, despite the extraordinary similarity in gross aspect, remain sharply characterized, and I have seen no specimen of ambiguous identity. Occasionally one character, such as the gland recessed into the notch of the wing, may fail (*A. Hess 35*, NY), but such individuals do not bridge the discontinuity. Where the two species occur together they occupy the same habitat. Probably the small, dull-hued flowers are autogamous, which would permit two closely related species to mingle without losing their identity. For rapid identification, the plane margins of the leaflets and the narrow bracts are the best and most easily observed diagnostic features of *D. mollis*.

No clear racial division is apparent in *D. mollis*. Wiggins (1940, p. 46, in clave) attempted to distinguish small-flowered, typical *D. mollis*, with calyx 3–4 mm long, from a subspecies *pilosa* with calyx at least 6 mm long. In my view the material presents an uninterrupted series, the calyx measuring from 3.3 to 6.6 mm disregarding pubescence and glands terminal to the teeth. Within a colony the flower is ordinarily very uniform in size, as might be expected of self-fertile species; nevertheless occasional plants are found growing in what appears to be an otherwise uniform population which would be referred, by Wiggins' criteria, to both subspecies (*Ripley & Barneby 4264*, NY). The petals vary much less than the calyx, the keel becoming more exserted as the teeth become shorter. An extremely short-toothed calyx is comparatively rare, known from scattered stations and groups of stations chiefly in and near the Salton depression (Yuma Desert; Borrego Valley; Coachella Valley), but has been found in Mohave County, Arizona (near Yucca), and as far south in Sonora as Guaymas. Large-flowered *D. mollis*, prevalent over Baja California (as suggested by Wiggins's map, 1940) has been collected as far north as Ehrenberg on the Colorado River, and at Thousand Palms near the species' northern limit in California.

6. DALEA MOLLISSIMA (Rydberg) Munz
(Plate XXXIII)

Closely resembling *D. mollis* up to the inflorescence, on the average coarser, the vesture of the foliage more readily tarnishing when dry; *stems* 0.5–3.5 (5) dm long; *leaf-spurs* (0.5) 1–3 mm long; *stipules* subulate (1) 1.5–3 mm long; *leaflets* 4–7 pairs, 3–9 (10) mm long, the margins strongly undulate-crenate; *racemes* at full anthesis and afterward (12) 13–16 (17) mm diam, the axis becoming 1.5–7.5 cm long; *bracts* 4.5–7 mm long, 1.1–1.6 mm wide; *glands* on pedicels 0.6–1 mm long, blackish-orange or black; *calyx* (5.8) 6.1–8.2 mm long, barbate with spiral hairs up to 1.5–2.2 mm long, the tube (2.5) 2.7–3.3 mm long, the intervals charged with one row of (3) 4–7 small orange glands, the teeth (3.1) 3.4–5.2 mm long; *petals* as in *D. mollis* except for the entire and glandless wing-tip; *banner* 2.8–3.7 mm long, the claw 1.3–2.1 mm, the blade (1.6) 1.8–2.2 mm long, (1.4) 1.7–2.2 mm wide; *wings* 2.4–3.1 mm long, the claw 0.6–1 mm, the oblong-ovate blade 1.8–2.2 mm long, 1.1–1.3 mm wide; *keel* 3.5–4 mm long, the claw 1–1.4 mm, the blades 2.6–2.9 mm long, 1.5–1.8 mm wide; *androecium* 4.3–5 mm, the anthers 0.4–0.5 mm long; 2n = 16 (Mosquin). — Collections: 81 (ii).

Desert flats, washes, and outwash fans, sometimes on desert mosaic, mostly 0–750 (840) m (0–2800 ft), in s. Nevada up to 1170 m (3900 ft), locally plentiful in years of good rainfall, s.-centr. and e. Mohave Desert, California, to Death Valley, the s. angle of Nevada, s. interruptedly through the Colorado Desert and the lower Colorado and Gila valleys in w. Arizona into the n.-e. corner of Baja California. — Flowering late January to May. — *Representative*: UNITED STATES. NEVADA: *Beatley 8387, 8625* (NY); *Purpus 6029* (SD, UC); *Kennedy* (from Muddy R.) *in 1906* (NY, UC). CALIFORNIA: *Twisselmann 11,948* (DAO, NY); *Hall & Chandler 6999* (UC); *Jones 3861* (NY, POM, UC); *C. L. Hitchcock 5846* (NY, UC); *Hitchcock & Muhlick 23,142* (NY); *Jepson 12.534* (JEPS). ARIZONA: *Maguire 15,500a* (NY, UC); *Gould & Macbride 4131* (NY, UC); *Barkley & Reed 4236* (DAO, NY). MEXICO. BAJA CALIFORNIA: *Wiggins & Wiggins 15,762* (DAO); *Epling et al.* (from Cucopah Mts.) *in 1943* (F, NY, UC); *Gander 2971* (SD). — To be expected in extreme n.-w. Sonora.

Dalea mollissima (Rydb.) Munz, Aliso **4**: 93. 1958, based on *Parosela mollissima* (very soft) Rydb., N. Amer. Fl. **24**: 64. 1919. — "Type collected at Las Vegas Wash, [Clark County,] Nevada, April 22, 1905, *Goodding 2237*..." — Holotypus, NY! isotypi, GH, UC! — *Dalea mollis* var. *mollissima* (Rydb.) Munz, Man. S. Calif. 263. 1935. *D. neo-mexicana* ssp. *mollissima* (Rydb.) Wiggins, Contrib. Dudl. Herb. **3**: 52. 1940.

For comments on relationship, differential characters, and partly sympatric dispersal of *D. mollissima* and *D. mollis*, see discussion of the latter. For quick identification the broad bracts and undulate leaf-margin are the most easily observed features of *D. mollissima*. The species differs from *D. neo-mexicana*, to which Wiggins subordinated it as a subspecies, in its annual root, small banner, and particularly in its disjointing keel. It is true that the glandless wings of *D. mollissima* and *D. neo-mexicana* are similar, but Wiggins, in my opinion, overemphasized the significance of the likeness. In other respects, alike morphological and ecological, *D. mollissima* has more in common with *D. mollis*. See my definition of *D. neo-mexicana*, above.

II B. Sectio LACHNOSTACHYAE (Rydberg) Barneby

Perennial herbs from tough, orange-red roots, the stems either erect or humifuse; *bracts* flask-shaped, enfolding the flower-buds, when laid open 3–5 mm wide, broadly

hyaline-margined; *petals* (fresh) vivid blue, often purplish-blue when dried; *blade* of banner truncately rounded or very shallowly cordate at base, obtuse or emarginate at apex; *prow* of pod greatly dilated, carinate lengthwise along each exterior margin; x = 7. — Spp. 2, of the Mexican Plateau and Chihuahuan Desert, Guanajuato and Aguas Calientes to trans-Pecos Texas, 1 extending w. to edge of Gila Basin in s.-e. Arizona and adjoining Sonora.

Dalea subgen. **Theodora** sect. **Lachnostachyae** (Rydb.) Barneby, comb. nov. et char. mut., a sect. *Theodora* bracteis magnis spathaceis fere subgeneris *Psoropteridis*, stylo filiformi, leguminisque sutura sub stylo nec dilatata nec bicarinata absimilis. — *Parosela* subgen. *Trichopodium* IX. *Lachnostachyae* Rydb., N. Amer. Fl. **24**: 63. 1919 ("*Lachnostachydes*"), pro parte. — Sp. lectotypica: *P. lachnostachys* (Gray) A. Hell. = **Dalea lachnostachya** Gray.

Key to the Species of Sect. *Lachnostachyae*

1. Stems erect, densely verruculose with prominent, subulate or prickle-shaped, livid glands at least as tall as their circumference at base; *leaflets* mostly 3–4, rarely 5 pairs, 7–17 mm long, pilose both sides, the terminal one stalked; *blades* of keel 4–4.5 mm long; centr. Chihuahua and w. Coahuila to w. Texas, w. to s.-e. Arizona and n.-e. Sonora. 7. *D. lachnostachya.*
1. Stems diffuse or humifuse, low-pustulate with obtuse, lens-like glands; *leaflets* 4–7 pairs, none over 1 cm long, glabrous both sides (only the rachis pilosulous), the terminal one sessile; *blades* of keel 2.7–3.7 mm long; s.-centr. Chihuahua to Guanajuato and San Luis Potosí. 8. *D. erythrorrhiza.*

7. Dalea lachnostachya Gray

(Plate XXXIV)

Erect perennial herbs (1) 1.5–4 dm tall, with few (mostly 1–5) simple or sparingly branched, densely and prominently verruculose stems terminating in 1–3 massive barbate inflorescences, pilose-pilosulous throughout with rather weak, sometimes contorted hairs, the vesture of stem short, the hairs less than 1 mm long, of leaves denser and longer, up to 1–1.8 mm long, the foliage bicolored, the expanded leaflets yellow- or golden-green above, glaucescent and prominently gland-pustulate around margins beneath; *leaf-spurs* 0.6–1.4 mm long; *stipules* subulate or subulate-attenuate, (1.5) 2–3.5 mm long, livid-castaneous becoming papery and fragile; *intra-* and *post-petiolular glands* small but prominent, globose or mammiform; *leaves* 3–8 (9.5) cm long, petioled, with scarcely margined, verruculose rachis and 2–5, mostly 3 or 4 pairs of obovate or oblong-obovate, obtuse or emarginate, flat leaflets (5) 7–17 mm long, their margins plane or obscurely crenulate, the terminal leaflet elevated above and a little longer than the last pair; *peduncles* 1–8 (11) cm long; *racemes* moderately dense, oblong-cylindroid, (1.5) 1.6–1.9 (2) cm diam, the flowers early spreading and the lower ones declined, the pilose axis finally 2.5–5 (6.5) cm long; *bracts* ovate-acuminate or -caudate, 7–11 mm long, 3.5–5 mm wide, folded around the flower-buds, rounded on the firm, pilosulous and gland-sprinkled back, often pink- or purple-tinged, the membranous margins glabrate, the short tail pilosulous; *pedicels* 0.3–0.7 mm long, rather stout, subtended at base and charged near apex with pairs of glands

up to 0.5 mm long; *calyx* (4.3) 5.8–7.7 mm long, pilose (especially along the prominent, cordlike ribs) with stiff straight spreading spiral hairs up to 3–4.5 mm long, the tube 2.6–3.1 mm long, the membranous intervals charged with 1 row of small yellowish glands, the deltate-aristate, livid, gland-spurred teeth nearly equal, (2.5) 3.1–4.5 mm long, plumose; *petals* blue (drying violet), the blades of all charged near base with 1 or few small orange glands, the epistemonous ones perched low on the androecium (within 1.5 mm above hypanthium), the banner (detached) longest, but (in situ) all appearing of equal length; *banner* 5.7–7.6 mm long, the claw 1.9–3.4 mm, the erect, ovate, shallowly cordate blade (3.5) 3.8–4.8 mm long, 2.2–3.8 mm wide; *wings* 5.2–6.6 mm long, the claw 1.2–1.8 mm, the oblong or oblong-oblanceolate, obtuse blade 3.7–5 mm long, 1.3–1.8 (2) mm wide; *keel* 5.4–7.1 mm long, the claws 1.5–2.4 mm, the narrowly oblong-obovate, very shortly auricled blade (3.8) 4–4.7 mm long, 1.7–2.2 mm wide; *androecium* 10-merous, 6.6–8.7 mm long, the longer filaments free for 2.3–2.9 mm, the connective glandless, the anthers (0.55) 0.6–0.75 mm long; *pod* (3) 3.3–4 mm long, hyaline in lower ½, thence papery and pilosulous, the dilated prow glabrous, 2-carinate; *seed* brown, smooth 1.8–2.4 mm long; 2n = 14 (Turner & Fearing; Mosquin), 7_{II} (Mosquin). — Collections: 48 (iii).

Open stony hills in arid grama grassland transitional to desert, 1050–1770 m (3500–5900 ft), not rare but seldom found in quantity, widespread over the Chihuahuan Desert between the foothills of Sierra Madre and the Mapimí Depression from s.-centr. Chihuahua (mpo Hidalgo del Parral) n.-e. into trans-Pecos Texas (Chisos, Chinati, Jeff Davis Mts., w. to Sierra Blanca) and the extreme n.-w. angle of Coahuila (Sas. de las Cruces and Hechiceros), and n.-w. (little known) into s.-w. New Mexico (Luna and s.-e. Grant cos), thence across the Divide to the margins of Gila Basin in s.-e. Arizona (to e. Pima and Santa Cruz counties) and immediately adjoining Sonora. — Flowering (May) July to October. — *Representative*: UNITED STATES. ARIZONA: *Goodding 216-59* (OKLA). NEW MEXICO: *Barneby 2480* (NY). TEXAS: *Warnock 13,825* (TEX); *Hinckley 879* (NY, RENNER); *Turner, Tharp & Warnock 53-527* (TEX); *Correll 33,922* (RENNER). MEXICO. SONORA: *Wright 982 in 1851* (NY). CHIHUAHUA: *Stewart & Johnston 2006, 2089, 2104* (GH, TEX); *Ripley & Barneby 13,856* (CAS, DAO, NY, MEXU), *13,871* (CAS, NY); *Mueller 3323* (F, UC); *Mosquin 6568, 6918* (NY). COAHUILA; *R. M. Stewart 464, 648* (GH).

Dalea lachnostachya (with shaggy spikes) Gray, Pl. Wright. **1**: 46. 1852 ("*lachnostachys*"). — "125...Hills about 80 miles west of the Pecos [± Barrilla Spring, e. Jeff Davis Co., Texas, acc. Hinckley, Amer. Midl. Nat. **44**: 490]; Aug." — Holotypus, collected by Charles Wright in 1849, GH! isotypi, NY, UC, US! — *Parosela lachnostachya* (Gray) A. Heller, Cat. N. Amer. Pl. ed. 2, 6. 1900.

An altogether unusual dalea, notable for its erect but short, densely livid-verruculose stems, few and large, softly pubescent leaflets yellow-green above but glaucescent and dotted beneath, and for the massive spikelike racemes of hispidly long-pilose calyces, when young tipped with a cone of forwardly overlapping bracts of a pale pinkish color. Its only close relative, *D. erythrorrhiza*, has prostrate stems and glabrous leaflets. In both the corolla is vivid blue when fresh, each petal charged at top of the claw with one or a small cluster of orange oil-glands, but the petals being narrow, little or not exserted, and quickly deciduous add little to the odd beauty of the raceme. As the seed ripens, the calyces disjoint one by one, floating away on the spread shuttlecock of the awnlike teeth, to reveal, persistent on the raceme-axis, the pairs of livid glands subtending the pedicels and borne laterally below their tips.

8. Dalea erythrorrhiza Greenman
(Plate XXXII)

Slender diffuse or prostrate herbs from a vertical or obliquely forking root and small knotty root-crown at soil-level, appearing glabrous up to the villous-barbate inflorescence but the upper edges of the leaf-rachis and the stipules thinly pilosulous-ciliolate with weak spreading hairs, the few (mostly 2–6) remotely leafy, castaneous or livid, simple or few-branched, low-tuberculate stems (1.5) 6–35 cm long, floriferous upward from near middle, the foliage subglaucescent, the leaflets pallid above, punctate beneath; *leaf-spurs* 0.5–1 mm long; *stipules* lance-subulate, castaneous or livid, becoming papery, 1.5–3 (3.5) mm long; *intra-* and *post-petiolular glands* prominent, rounded; *leaves* slender-petioled, (1) 1.5–5 (6) cm long, with scarcely margined rachis and 4–7 pairs of obovate- or oblong-cuneate, truncate-emarginate to openly retuse, thick-textured, flat or loosely involute leaflets (2) 3–9 (11) mm long, their margins elevated but scarcely undulate; *peduncles* both leaf-opposed and terminal, 0–3 cm long; *racemes* moderately dense, ovoid or ovoid-ellipsoid becoming oblong-cylindroid, 14–18 mm diam, the flowers declined after anthesis, the glabrous axis finally (1) 1.5–5.5 cm long; *pedicels* 0.3–0.9 mm long, the prickle-shaped subtending glands 0.2-0.4 mm long; *calyx* 5.8–7.1 mm long, villous with fine, straight, stiffly spreading spiral hairs up to 2.7–4 mm long, the tube 2.3–2.7 mm long, pleated, the purple-tinged ribs becoming prominent, the rather firm but (seen from within) membranous intervals charged with 1 row of 3–5 small transparent glands, the deltate-aristiform teeth subequal, 3.5–4.7 mm long, charged with 1–4 pairs of gland-spurs, plumose; *petals* blue (purplish when dried), all charged at base of blade with a cluster of small orange glands, the epistemonous ones perched within ± 1 mm of hypanthium, the banner (detached) usually longest, all (in situ) shorter than the calyx-teeth; *banner* (4.9) 5.4–6.5 mm long, the claw (2.1) 2.3–3.1 mm, the ovate or ovate-oblong, entire, scarcely cordate blade 2.9–3.7 mm long, 2.4–2.8 mm wide; *wings* 4.7–5.7 mm long, the claw 1.4–1.9 mm, the narrowly oblong or lance-oblong blade 3.1–3.8 mm long, 1.2–1.5 mm wide, scarcely auriculate at base; *keel* 4.7–5.8 mm long, the claws 1.6–2.4 mm, the narrowly (subsymmetrical) ovate-oblong blades 2.7–3.7 mm long, 1.5–1.8 mm wide; *androecium* 10-merous, 5.5–7 mm long, the longer filaments free for 2.2–3 mm, the connective glandless, the anthers 0.4–0.5 mm long; *pod* 2.5–6 mm long, in profile broadly obliquely cuneate, the style-base latero-terminal, its prow laterally dilated, 0.6–0.8 mm wide, glabrous, the valves hyaline at base, papery, pilose and glandless distally; *seed* (seldom seen) 2.1–2.3 mm long; 2n = 14, 7_{II} (Mosquin). —Collections: 15 (v).

Low hills, knolls, eroded stream-banks, in grama grassland, sometimes with mesquite, 1550–2500 m (5200–8200 ft), mostly on eruptive, rarely calcareous substrates, local but forming colonies, Meseta Central of Mexico from s.-centr. Chihuahua (mpos Cd. Camargo and Hidalgo del Parral) s.-e., mostly e. of the Sierra Madre piedmont, through Durango, Zacatecas, and Aguas Calientes to n. Guanajuato (mpo S. Miguel de Allende) and n. San Luis Potosí (mpo Charcas). —Flowering June to November. —*Representative*: Chihuahua: *Ripley & Barneby 13,929* (CAS, MEXU, MICH, NY, US). Durango: *Mosquin et al. 6910* (NY); *Palmer 293* (F, NY); *Ripley & Barneby 14,164* (DAO, DS, NY). Zacatecas: *Gentry 8536* (UC); *Ripley & Barneby 13,469* (MEXU, NY), *14,144* (CAS, DAO, NY). Aguas Calientes: *Rose & Painter 7703* (F, NY, US); *McVaugh 23,682* (MICH, NY). San Luis Potosí: *Lundell 5085* (ARIZ, NY). Guanajuato: *Kenoyer 2189* (GH).

Dalea erythrorrhiza (with red root) Greenm. in Zoë **5**: 185. 1904. — "MEXICO. State of Durango: near the city of Durango, April to November, 1896. *Dr. Edward Palmer,* No. 486 (hb. Gr.). State of Zacatecas; in gravelly soil, near the city of Zacatecas...August, 1903, *C. A. Purpus*, No. 452..." — Holotypus (*Palmer 487*), GH! isotypi, F, NY, UC; paratypus (*Purpus 452*), GH! — *Parosela erythrorrhiza* (Greenm.) Rose, Contrib. U. S. Nat. Herb. **10**: 105. 1906.

This is one of a small company of daleas, not closely related but alike in their humifuse habit, found on the thin prairies of the Mexican Plateau, drought-resistent plants that continue to grow and flower, with some loss of stem leaves, long after the grasses have turned sere and yellow. Among them *D. erythrorrhiza* is recognized at anthesis by the large membranous glabrous bracts that form a sort of imbricated cap on the young racemes, by the blue petals all shorter than the long-hispid calyx-teeth, by the overlapping keel-blades, and later on by the pod's broadly dilated, glabrous prow. In form of the raceme and flower *D. erythrorrhiza* can be compared only with *D. lachnostachya*, which replaces it as the plateau dips northward into the Chihuahuan Desert. It is a much less showy plant than its relative, its distantly leafy, red or livid stems, creeping inconspicuously through the thin turf or over gravel colored like themselves, being hard to see until furnished with the turrets of hispid calyces.

III. Subgenus DALEA

Epistemonous petals imbricate in vernation, the inner pair at anthesis either free or (less often) narrowly overlapping and adherent by their faces, the dehiscing anthers exposed or exserted; *androecium* (4) 5–10-merous; *flowers* sessile; *herbs* (annual or perennial), sometimes suffrutescent in age; x = 7.

Key to the Sections of Subgen. *Dalea*

1. Blade of the banner plane at base, not produced across the top of the claw to form a cornet.
   2. Androecium deeply cleft, the free filaments about as long as the column or column and sheath combined; *perennial herbs*, some precociously flowering, some suffrutescent in age.
      3. Filaments (7) 9–10; *epistemonous petals* perched at or well below separation of the filaments; range largely in w. Mexico extending into s.-w. United States. IIIA. Sec . *Thornbera* (p. 168)
      3. Filaments exactly 5; *epistemonous petals* perched at or almost at separation of the filaments; range largely in United States, one extending into n.-w. Mexico. IIIC. Sect. *Kuhnistera* (p. 220)
   2. Androecium shallowly cleft, the free filaments ⅓ or less as long as the column or column and sheath combined; *annual herbs* (sometimes coarse and tall); largely Mexican, but few extending into s. (centr.) United States, some through Central America and adventive elsewhere. IIIB. Sect. *Dalea* (p. 189)
1. Blade of banner peltate, the basal lobes fused across the top of the claw and forming a cornet behind it; *androecium* shallowly cleft; *perennial herbs*, obligate psammophytes, of s.-w. and s. centr. United States and extreme n. Mexico. IIID. Sect. *Elaspora* (p. 280)

IIIA. Sectio THORNBERA (Rydberg) Barneby

Perennial herbs, sometimes weakly suffruticose (*D. elata* precociously flowering, then appearing annual); *epistemonous petals* all free, perched half-way between hypanthium and anthers or well below that level; *androecium* 9–10-merous, the filaments (except in *D. elata*, transitional to sect. *Dalea*) deeply separated, the tassel ± as long as the column (or as the column + sheath). — Spp. 9, of w. and s. Mexico and s.-w. United States.

Dalea subgen. **Dalea** sect. **Thornbera** (Rydb.) Barneby, stat. nov., based on *Thornbera* Rydb., Jour. N. Y. Bot. Gard. **20**: 66. 1919. — Generitypus: *Th. albiflora* (Gray) Rydb. = **Dalea albiflora** Gray. — *Dalea* subgen. *Thornbera* (Rydb.) Macbr., Contrib Gray Herb, New Ser. **65**: 22. 1922.

Key to the Series and Species of Sect. *Thornbera*

1. Filaments free through 2.5–4.5 mm, the tassel ± as long as the column and sheath combined.
   2. Stems and foliage ± pubescent or, if (rarely) glabrous, the bracts pubescent within; *epistemonous petals* perched either near or well below separation of the filaments (if near, the foliage densely pubescent); *terminal leaflet* not elevated beyond the last pair; ser. *Thornbera* (p. 169).
      3. Foliage (especially low on the stems, often throughout) ± pubescent; *bracts* glabrous within; *calyx-tube* recessed behind the banner; *leaflets* of larger leaves ± 8–20 pairs.
         4. Calyx pubescent externally from base upward, the ribs slender but early becoming prominent, the intervals charged with ± prominent glands, the teeth subequidistant around the orifice, the dorsal sinus deeper but little wider than the rest; *spikes* dense but not conelike, the larger ones oblong-cylindroid, 1.5–7 cm long; *interfloral bracts* triangular to triangular-acuminate; *petals* all white; Durango to s.-w. New Mexico and s.-e. Arizona. 9. *D. albiflora.*
         4. Calyx glabrous externally, either throughout or below the middle, the subfiliform ribs immersed, the intervals glandless or charged with minute, transparent glands hardly visible externally, the teeth all crowded together toward the abaxial side of the orifice, the dorsal sinus both much wider and much deeper than the rest; *spikes* conelike, the larger ones ovoid-subglobose, up to 1.5 (exceptionally 3) cm long; *interfloral* bracts rhombic-spatulate; *petals* rarely all white, the epistemonous ones commonly blue or bluish; n.-w. Chihuahua, n.-e. Sonora, and adjoining Arizona. 10. *D. lumholtzii.*
      3. Foliage glabrous; *bracts* densely silky-pilosulous within; *calyx-tube* scarcely recessed behind the banner, the tube glabrous except for a few scattered hairs along the back, indistinctly ribbed, almost eglandular; *leaflets* 6–8 pairs; *spikes* and *interfloral bracts* nearly of *D. lumholtzii*; s.-e. Sonora. 11. *D. ananassa.*
   2. Stems, foliage, and inner face of interfloral bracts glabrous; epistemonous petals perched at or close under the separation of the filaments.

5. Stems prominently angulate-ribbed, not or only remotely and minutely glandular-punctate or -verruculose; *terminal leaflet* elevated beyond the last pair; *calyx* densely silky-pilose externally: ser. *Laevigatae* (p. 175).
   6. Petals all opening white (the banner faintly rubescent in age); *plants* mostly 3–7 dm tall with larger spikes 1–6 cm long; *calyx-teeth* commonly no longer than the tube, mostly 1–2.4 (rarely to 3.2) mm long.
      7. Leaflets 8–21 pairs, elliptic-oblanceolate to narrowly obovate, loosely folded, usually ascending along the rachis; *intervals* of the calyx charged with ± 3–6 small, pale yellow glands; s.-w. New Mexico to s.-e. Arizona, n. Durango, and n. Sinaloa. 12. *D. grayi.*
      7. Leaflets 3–9 pairs, linear to elliptic-linear, usually tightly involute and incurved; *intervals* of the calyx eglandular or almost so; s. Sonora and adjoining Chihuahua s. along Pacific slope to w. Jalisco. 13. *D. revoluta.*
   6. Petals (except sometimes in var. *multijuga*) all bright magenta purple; *calyx-teeth* commonly longer than the tube, 2.2–4 mm long, shorter only in var. *oxyphyllidia*, which has purple petals; if the *petals* white, the stems virgately erect, few, and 7–25 dm tall; s.-e. Arizona to s.-w. Chihuahua and adjoining Sonora and Sinaloa. 14. *D. pringlei.*
5. Stems subterete but densely and prominently verruculose with elevated glands; *terminal leaflet* inserted at level of the last pair, forming a trefoil; *calyx* glabrous externally, the tube lustrously membranous.
   8. Calyx-tube deeply recessed behind the banner, its teeth ovate, broader than long; *petals* blue and white, glandless; *intervals* of calyx-tube charged with many small glands in several ranks; Sierra Madre in s. Chihuahua and Durango: ser. *Nelsonianae* (monotypic). 15. *D. nelsonii.*
   8. Calyx-tube not recessed behind the banner, its teeth half-circular, broader than long; *petals* yellow, gland-tipped; *intervals* of calyx-tube charged with one rank of few, large glands; Oaxaca: ser. *Rubroluteae* (p. 184). 16. *D. rubrolutea.*

1. Filaments free for 1.6–2 mm, the tassel ±½ as long as the column and sheath combined. Calyx-tube strongly pleated, the (yellowish) ribs becoming prominent, the narrow, recessed intervals charged with 2–4 (6) black or orange (rarely pallid) glands, the orifice subsymmetrical, the triangular-aristate teeth as long or a little longer than the tube; *petals* whitish, the small epistemonous ones perched nearly half-way between hypanthium and anthers but well below the short filament-tassel; w. and s. Mexico, mostly in *tierra caliente*: ser. *Flavae* (monotypic)(p. 186). 17. *D. elata.*

IIIA (i) Series Thornbera

Herbaceous or suffruticulose; *stems* subterete; *terminal leaflet* inserted at level of last pair; *calyx-tube* commonly recessed behind the banner (scarcely so in rare *D. ananassa*); *epistemonous petals* perched nearly at or well below separation of the filaments, these deeply divided, the tassel ± as long as column and sheath combined; *petals* all white, or (*D. lumholtzii*) the inner ones sometimes blue; spp. 3; Sierra Madre Occidental from s.-w. Durango n. into s.-w. United States.

Dalea subgen. **Dalea** sect. **Thornbera** ser. **Thornbera.** *Dalea* sect. *Thornbera* (Rydb.) Barneby, ser. typ. — Sp. typica: **D. albiflora** Gray.

Petalostemon VI. *Pilulosi* Rydb., N. Amer. Fl. **24**: 121, in clave. 1920. — Sp. lectotypica: *P. pilulosus* Rydb. = **Dalea albiflora** Gray.

Despite its small size, ser. *Thornbera* is somewhat heterogeneous in detail. The typical species has spikes not especially dense, a calyx coarsely ribbed and glandular, and high-perching epistemonous petals, whereas *D. lumholtzii* and *D. ananassa* have short cone-like spikes, calyces faintly ribbed and almost glandless, and low-perching petals. The last-named is notable for its glabrous foliage and internally silky bracts.

9. Dalea albiflora Gray

(Plate XXXV)

Perennial from an eventually woody root and short caudex, (2) 2.5–5 (7) dm tall, silky-villosulous with weakly ascending (the stems sometimes with horizontal or subretrorse) hairs up to 0.3–1 mm long, the erect or less often diffuse stems usually branched near the base and also distally, sparsely glandular-verruculose, the foliage greenish or cinereous, the leaflets punctate beneath; *leaf-spurs* 0.4–0.9 mm long, charged on each side with a gland; *stipules* linear-subulate to subaristiform, 1–4.5 mm long, usually livid and glabrescent; *intrapetiolular glands* minute or obsolete; *post-petiolular glands* prominent, conic, orange or purplish; *leaves* 1–4 cm long, sessile or shortly petioled, with margined, greenish or sparsely punctate rachis and (6) 8–17 (20) pairs of oblanceolate, oblong- or linear-elliptic, more rarely oblong to narrowly obovate, mostly emarginate or very obtuse, flat or folded leaflets (1.5) 2–7 (10) mm long; *peduncles* terminal to all branches, 0.5–8.5 cm long; *spikes* dense but not cone-like, ovoid or narrowly conic in outline becoming oblong- or narrowly cylindroid, without petals or androecia 7–10 mm diam, the villosulous axis becoming (1) 1.5–6 (7) cm long; *bracts* persistent, narrowly triangular to triangular-acuminate, pubescent dorsally (the lowest sometimes glabrate), the tips usually livid-castaneous and ± glandular; *calyx* (2.8) 3.2–5.1 mm long, pilosulous externally, the tube (1.9) 2–3 (3.3) mm long, deeply cleft behind the banner, the slender ribs becoming prominent, yellowish or brownish, the intervals membranous and charged with one row of ± 3–6 yellow glands, the triangular-cuspidate teeth entire, (0.9) 1.1–1.8 (2.1) mm long; *petals* white, eglandular, the epistemonous ones perched close to or shortly below separation of the filaments; *banner* (4.4) 5–6.4 mm long, the claw (1.8) 2–3.3 mm, the oblong-ovate or -elliptic, basally cuneate or subcordate blade (2.6) 3–4 mm long, (2) 2.2–3.4 mm wide; *wing-* and *keel-petals* similar, (3.4) 3.8–5.8 mm long, the claws (0.6) 1–1.9 mm, the oblanceolate to oblong blades usually cuneate at base, (2.7) 3.1–4.4 mm long, (0.8) 1.3–1.9 (2.2) mm wide, those of the inner pair sometimes more broadly obovate-oblanceolate and minutely auriculate at base on the inner side; *androecium* 10-merous (but one anther sometimes barren), (5) 6–8 mm long, the filaments free for ± 3.5–4.5 mm, the connective gland-tipped, the yellow anthers 0.4–0.6 mm long; *pod* broadly obliquely obovoid, 2.2–2.8 mm long, 1.7–2.1 mm wide, the style-base terminal but excentric, the valves in distal third thinly papery, villosulous, and gland-sprinkled, glabrous and hyaline proximally; *seed* 1.6- 2 mm long. — Collections: 75 (iii).

Dry stony hillsides and grassy flats in the oak and pine belts of the Sierra Madre, northward coming out onto valley grasslands, 1050–2250 m (3500–7300 ft), common and locally abundant from extreme n. Durango (mpo. Villa Ocampo) through w. Chihuahua and adjoining Sinaloa (Sa. Surutato) and Sonora to the headwaters of the Gila River in centr. and s.-e. Arizona (n. to Yavapai, Gila, and Graham counties) and s.-w. New Mexico (to Grant and adjoining Sierra counties). — Flowering primarily in September to November, sometimes again in spring. — *Representative*: UNITED STATES. ARIZONA: *Blumer 1476* (L, NY, W); *Kearney & Peebles 14,460* (NY, UC); *Maguire 12,129* (NY, UC). NEW MEXICO: *Metcalfe 1405* (NY, UC); *Barneby 5120* (CAS, NY). MEXICO. SONORA: *Hartmann 134* (F, NY, UC); *S. S. White 3489* (ARIZ, MICH). CHIHUAHUA: *Pringle 1586* (F, MICH, UC), *990* (F, NY); *M. & G. Ownbey 2023* (F, NY, UC); *Gentry 2861* (ARIZ, F); *Pennell 18,787* (GH, NY); *Ripley & Barneby 13,870* (CAS, NY, US); *Goldman 159* (GH, NY). DURANGO: *Pringle 13,515* (ARIZ, L, M, MICH, TEX). SINALOA: *Breedlove & Thorne 18,559* (NY).

Dalea albiflora (white-flowered) Gray, Pl. Wright. **2**: 38. 1853. — "Hill-sides on the San Pedro and Barbocomori, Sonora; Sept. (987)." — Holotypus, collected in 1851 by Charles Wright, GH! isotypi, NY, US! — *Parosela albiflora* (Gray) Vail, Trans. N. Y. Acad. **14**: 34. 1894. *Thornbera albiflora* (Gray) Rydb., Jour. N. Y. Bot. Gard. **20**: 66. 1919.

Dalea ordiae ("Mrs. Dr. Ord", a friend of J. G. Lemmon) Gray, Proc. Amer. Acad. **17**: 200. 1882. — "Plains near Bowie and Rucker Valley, S. Arizona, Lemmon, 1881." — Holotypus, from "Camp Rucker, Chiricahua Mts.. *Mrs. Dr. Ord*, Sept. 1880 (from J. G. Lemmon)", GH! — *Parosela ordiae* (Gray) Vail, Trans. N. Y. Acad. Sci. **14**: 34. 1894; Heller, Catal. N. Amer. Pl., ed. 2, 6. 1900. *Thornbera ordiae* (Gray) Rydb., N. Amer. Fl. **24**: 119. 1920.

Parosela watsoni (Sereno Watson, 1826–1892) Rose, Contrib. U. S. Nat. Herb. **10**: 106. 1906. — "Type U. S. National herbarium no. 24472, collected by Dr. E. Palmer at Frayles, Chihuahua, 1885 (no. 252)..." — Holotypus, US! isotypi, GH, NY, UC! — *Thornbera watsoni* (Rose) Rydb., N. Amer. Fl. **24**: 117. 1920. *Dalea watsoni* (Rose) Gentry, Rio Mayo Plants 140. 1942, excl. syn.

Thornbera villosa (softly pubescent) Rydb., N. Amer. Fl. **24**: 118. 1920. — "Type collected in the Santa Rita Mountains, Arizona, 1902, *Griffiths & Morris 130*..." — Holotypus, NY! — *Th. albiflora* ssp. *villosa* (Rydb.) Wiggins, Contrib. Dudl. Herb. **3**: 54. 1940. *Dalea rydbergii* (Per Axel Rydberg, 1860–1931) Tidest. in Tidest. & Kitt., Fl. Ariz. & New Mex. 183. 1941 [non *D. villosa* (Nutt.) Spreng., 1826].

Dalea albiflora var. *brevibracteata* (with short bracts) Jones, Contrib. W. Bot. **12**: 7. 1908. — "Colonia Juarez, Chihuahua, Mex...also Guayanopa Canon and San Diego Canon, Sept. 1903..." — Lectoholotypus, from San Diego Canyon, 16 Sept 1903, *Jones s. n.*, POM! paratypus, from Colonia Juárez, 12 Sept 1903, in bud only, *Jones s. n.*, POM!

Thornbera leucantha (white-flowered) Rydb., N. Amer. Fl. **24**: 118. 1920. — "Type collected near Providencia, Durango, Sept. 11–12, 1898, *E. W. Nelson 4996*.." — Holotypus, US! isotypus, NY!

Petalostemon pilulosus (with little balls, of the immature spikes) Rydb., N. Amer. Fl. **24**: 128. 1920. — "Type collected in Arizona, 1891, *Nealley 237*.." — Holotypus, NY!

Dalea gentryi (Howard Scott Gentry, 1903–) Standl., Field Mus., Bot. **22** (1): 26. 1940. — "MEXICO: Arroyo Hondo, Sierra Charuco, Chihuahua, in canyon bottom among pines, September 12, 1935, *Howard Scott Gentry 1809*..." — Holotypus, F! isotypi, ARIZ, GH, MEXU, NY, UC, US!

My concept of *D. albiflora* embraces five of Rydberg's species of *Thornbera*, one of *Petalostemum*, a variety of *D. albiflora* proposed by M. E. Jones, and the more recently described *D. gentryi* Standl. The weight of synonymy suggests an extraordinarily polymorphic species, but it is in reality variable in only a few, relatively trivial and, it appears, uncorrelated features, notably in the length and density of the pubescence, flower-size (and in consequence thickness of the spikes), and length of bracts and calyx-teeth relative to that of the calyx-tube. The commonest type of pubescence consists of sinuous, ascending hairs mostly less than 0.4 mm long, occasionally mixed on the stems with some longer hairs. In southeastern Arizona and northern Sonora the pubescence of the stem is often horizontally spreading or even slightly retrorse, the longer hairs varying from ± 0.4 to nearly 1 mm long. To this type belong the original *D. albiflora* and *Thornbera villosa*. Gray described *D. ordiae* as related closely to *D. albiflora* but different in its shorter-toothed, more prominently glandular calyx combined with less densely pubescent foliage, but from the vantage point of after-knowledge, based on a now extensive herbarium record, these contrasts seem feeble and in practice are unworkable. Rydberg thought that *Th. ordiae* could be separated from *Th. albiflora* by its short bracts and relatively short leaflets, but these two characters are not necessarily associated, and the majority of specimens annotated as *Th. albiflora* (NY) by Rydberg have the short bracts attributed to *Th. ordiae*. Kearney & Peebles (1960, p. 435) divided the Arizona material into a relatively coarse, broad-leaved *D. albiflora* and a more slender, silky, narrow-leaved *D. ordiae* but this is an artificial sorting of specimens, the species so defined being confluent morphologically and sympatric in dispersal. A slender form of *D. albiflora*, with narrow spikes, was collected by Charles Wright as early as 1851, and mentioned by Gray in *Plantae Wrightianae* as an unnamed forma; similar plants served as basis of *Dalea gentryi*. In general it may be said that the populations in Arizona and New Mexico tend to have coarser, more erect stems and thicker spikes than the diffuse, smaller-flowered (and often small-leaved) populations in Chihuahua and Sonora, but the passage between the extremes is gradual and now well documented. The type-collection of *Parosela watsoni* is mostly in advanced fruit, has narrow spikes but long pubescence; it is one of the most clearly intermediate forms.

10. Dalea lumholtzii Robinson & Fernald
(Plate XXXVI)

Herbaceous from a woody root, becoming suffruticulose, 1.5–5 (6) dm tall, the loosely tufted, erect or assurgent, finely ribbed and verruculose stems simple or branched from near the middle, commonly giving rise at base, late in the season, to many short, leafy but barren shoots, densely pilosulous to thinly puberulent throughout with fine, subappressed or loosely ascending hairs up to 0.3–0.8 mm long, the vesture commonly denser proximally, the upper leaves sometimes glabrous or nearly so except for the puberulent rachis, the foliage either green or cinereous, the leaflets dotted both above and beneath; *leaf-spurs* 0.4–0.8 mm long, charged dorsally on each side with a large gland; *stipules* narrowly subulate or subsetiform, castaneous or livid, 1–2.8 mm long, becoming dry and fragile; *intrapetiolular glands* obsolete; *post-petiolular glands* prominent, obtuse; *main cauline leaves* shortly petioled, (2) 2.5–5 cm long, with narrowly margined, commonly punctate rachis and 10–17 pairs of linear, linear-oblanceolate, or -elliptic, obtuse or retuse, thick-textured, usually conduplicate or channeled leaflets 2–9 (10) mm long, the leaves of basal spurs smaller, with mostly 4–10 pairs of leaflets only 1.5–3 mm long; *peduncles* terminal to all branches, (1.5) 2.5–10 cm long; *spikes* very dense, conelike, ovoid becoming subglobose, ovoid, or

the first, central one becoming oblong-cylindroid, without petals 6–8.5 mm diam, the axis becoming 0.4–1.4 (3) cm long; *bracts* persistent, dimorphic, (1.5) 2–4 mm long, the lowest obovate-flabellate to rhombic-ovate, glabrous or puberulent, but ciliolate below the middle, purplish-castaneous and glandular dorsally, the interfloral ones rhombic-spatulate, densely pilosulous dorsally in lower half or sometimes throughout, the tips often glabrous dorsally but ciliolate; *calyx* 2.7–4 (4.3) mm long, subglabrous externally or puberulent distally, the oblong-ovoid, slightly incurved tube 2.1–2.8 (3) mm long, deeply and widely recessed behind the banner, the ribs filiform, castaneous distally, the membranous intervals eglandular (or minutely glandular as seen from within), the subulate teeth crowded toward the abaxial side of the orifice, ± incurved, unequal, the dorsal one longest, up to 0.4–1.3 (1.5) mm long; *petals* either all white or bicolored, the banner then white and the epistemonous ones blue, these perched 0.9–2.4 mm distant from the hypanthium, well below separation of the filaments; *banner* 3–5.2 (5.9) mm long, the claw 1–2.6 (3.2) mm, the ovate-elliptic or rhombic-suborbicular blade 2–2.4 mm long, about as wide; *wing-* and *keel-petals* similar, 2.6–5.5 mm long, the inner pair slightly smaller but inserted a little higher and therefore appearing as long, the narrowly oblong-oblanceolate blades 2.3–4 mm long, 1.1–1.3 mm wide, contracted at base into a claw 0.4–1.8 mm long; *androecium* 10-merous, 5–7.7 mm long, the filaments free for 2.6–3.7 mm, the connective gland-tipped, the anthers 0.6–0.65 mm long; *pod* obliquely ovoid, the style-base lateral but scarcely below the apex, the sutures filiform, the valves membranous nearly throughout, thinly chartaceous and puberulent along the prow, eglandular; *seed* ± 1.7 mm long. — Collections: 15 (o).

Open rocky hillsides in the oak-madrone and oak-pine belts, 1400–1900 m (4700–6700, perhaps "7000" ft), local and discontinuous along the Pacific slope of n. Sierra Madre Occidental, best known from the great bend of Río Bavispe in mpos. Nacozari de García, Bacerac, and Bavispe, Sonora and immediately adjoining mpo. Janos, Chihuahua, s. just within Chihuahua on Sierra de Vallecillos, drainage of Río Papigochic (mpo. Madera), and about the upper affluents of Río Mayo (mpos. Moris and Ocampo), n.-ward at isolated stations in s.-e. Arizona, on Pajarito and Tumacacori Mts. (Santa Cruz Co.,), Baboquivari Mts. (Pima County) and reportedly Santa Catalina Mts. (Pima County; cf. *Parosela arizonica* infra). — Flowering August to October. — *Representative*: ARIZONA: *Gould, Darrow & Haskell 2720* (NY, UC); *Goodding 1702* (US). SONORA: *S. S. White 3192* (ARIZ, GH, MICH), *3484* (ARIZ, GH, MEXU, MICH), *4179* (ARIZ, GH, MICH). CHIHUAHUA: *Tucker 2511* (UC); *LeSueur 709* (ARIZ, F, GH, TEX); *S. S. White 2521* (ARIZ, GH, MEXU, MICH); *Gentry 2795* (ARIZ).

Dalea lumholtzii (Carl Lumholtz, anthropologist, 1851–1922) Robins. & Fern., Proc. Amer. Acad. **30**: 115. 1894 ("*Lumholtzii*"). — "Collected at Las [sic] Pinitos, Sonora, at 6100 feet, by Mr. Hartman, 14 October, 1890 (no. 133)." — Holotypus, GH (2 sheets)! isotypi, NY, UC, US! — *Parosela lumholtzii* (Robins. & Fern.) Vail, Bull. Torrey Club **26**: 117. 1899.

Parosela arizonica (of Arizona) Vail, Bull. Torrey Club **24**: 14. 1895 ("*Arizonica*"). — "Vicinity of Tucson, Arizona; collected by Herbert Brown, October, 1895." — Holotypus, communicated by Alice Eastwood, who received it "from an editor of a country paper who received it from a ranchman," perhaps collected in Santa Catalina Mts., NY! — *Dalea arizonica* (Vail) K. Schum., Bot. Jahresb. **27**[1]: 493. 1901.

Dalea astragalopsis (with aspect of some *Astragalus*) Standl., Field Mus., Bot. **22** (1): 25. 1940 ("*Astragalopsis*"). — "Mexico: Sierra Canelo, Rio Mayo, Chihuahua... August 26, 1936, *Howard Scott Gentry 2479*." — Holotypus, F! isotypi, ARIZ, GH, K, UC!

In habit, foliage, and type of pubescence this elegant dalea resembles the more slender forms of *D. albiflora*, though obviously different in its short, conelike flower-spikes, and when closely observed in the faintly nerved, externally glabrate, short-toothed and strongly oblique calyx. The spikes, which suggest after anthesis, because of their closely imbricated, dusky-tipped bracts, the "hardheads" of some *Centaurea*, are much like those of the next species, *D. ananassa*, but this has much fewer, glabrous leaflets, a calyx only slightly recessed behind the banner, and bracts densely pubescent on the inner face. The typus of *D. lumholtzii* appears, like the few known Arizona populations of the species, to have uniformly white flowers, but the epistemonous petals of most modern collections from Sonora show a variable depth of blue color when dried. Assuming that the type-station is at or close to Cerro Pinitos at 30° 30′ N, 109° 30′ W, that is on the west side of the Bavispe valley oppostie El Tigre Mine where the blue-flowered forms have been collected, the presence of anthocyanin is not correlated with dispersal. The pubescence of *D. lumholtzii* is now known to vary in length and density as much as that of *D. albiflora*. Thus the relatively thick-pubescent, blue-flowered *D. astragalopsis* appears to have been described from a taxonomically insignificant variant.

Collectors have repeatedly noticed and recorded the strong and agreable scent of the crushed foliage of *D. lumholtzii*, described as resembling that of lemon-balm (*Melissa*) or lemon-verbena (*Aloysia*). In Sonora the species is known as *limoncillo*, and an infusion of the leaves is drunk under the name *té limón*.

11. Dalea ananassa Barneby
(Plate XXXVI)

Weakly suffruticose perennial herbs up to 3.5–7 dm tall, glabrous to the spikes, the finely striate-ribbed, pale green or stramineous, distally micro-tuberculate stems branching nearly throughout and terminating in a loose, sparsely leafy panicle of small conelike spikes, the foliage green or subglaucescent, often reduced upward, the leaflets smooth or sometimes dotted above, punctate beneath; *leaf-spurs* 0.3–1 mm long; *stipules* subulate rigid 0.6–2 mm long; *intrapetiolular glands* minute or 0; *postpetiolular glands* small, pale yellow, dentiform; *main cauline leaves* very shortly petioled, 2.5–4.5 cm long, with 6–9 pairs of narrowly elliptic, acute, openly boat-shaped, dorsally keeled leaflets 5–11 (13) mm long, the upper leaves usually shorter, with ± 3–6 pairs of smaller leaflets; *peduncles* both leaf-opposed and terminal to branchlets, 1–4.5 cm long; *spikes* very dense, ovoid or globose, without petals or androecia 5–7 mm diam, the (concealed) villosulous axis (4) 6–12 mm long; *bracts* 1.7–2 mm long, dimorphic, the lowest small, ovate, glabrous or nearly so dorsally, the rest rhombic-ovate short-acuminate, barbate dorsally at base thence glabrate and (especially toward glabrate tip) gross-glandular, all ciliate and densely silky-pilosulous within; *calyx* 2.5–3 mm long, glabrous except for the internally pilosulous teeth and orifice and for a few scattered hairs along the back, the narrowly campanulate, terete, pallidly membranous, indistinctly ribbed tube 1.9–2.3 mm long, shallowly recessed behind banner, the intervals inconspicuously glandular (glands minute, visible only from within), the teeth subulate, subequal, incurved at apex, up to 0.6–0.7 mm long, green, gland-tipped; *petals* white or (dry) faintly blue-tinged, glandless, the epistemonous ones perched 1–1.4 mm above hypanthium, the blades of inner pair weakly adherent in bud, free at anthesis; *banner* (caducous) 3–4.4 mm long, suberect, the ovate or oblong obtuse blade 2.2–3.2 mm long, 1.2 mm wide, cuneately contracted at base into a short claw; *wing-* and *keel-petals* almost alike, 3.3–4.7 mm long, the oblanceolate, truncate or obtuse blades 0.9–1.2 mm wide, narrowed at oblique but

exauriculate base into a short claw; *androecium* 10-merous, 4.5–5 mm long, the longer filaments free for 2.3–2.5 mm, the connective gland-tipped, the anthers 0.55 mm long; *pod* narrowly obovoid, compressed, 2.5 mm long, the style-base terminal but eccentric, the sutures subfiliform, the valves hyaline in lower ⅔, thinly papery and pilosulous distally. — Collections: 2 (o).

Pine-oak forest, 1200–2160 m, apparently rare and local, known only from Sierra Tecurahui in s.-e. Sonora and Sierra Surutato in e.-centr. Sinaloa. — Flowering September to November. — *Material*: SONORA. Alamos: typus. SINALOA. Badiraguato: Bufa de Surutato 3 mi. s.-e. of Los Ornos, *Breedlove & Thorne 18,544* (NY).

Dalea ananassa (pineapple, from the form of the spikes) Barneby, sp. nov., *D. lumholtzii* affinis habituque similis sed caulibus foliisque perglabris nec puberulis, foliolis 6–9 (nec 10–17)-jugis acutis nec obtusis, bracteisque brevioribus intus dense sericeo-pilosulis nec glabris statim recognita. — SONORA. Alamos: pine-oak forest, 4000–4500 ft., Sierra Tecurahui, Oct 26–28, 1961, *Gentry, Barclay & Arguelles 19,384*. — Holotypus, US; isotypus, RENNER.

This strongly characterized species has much in common with *D. lumholtzii*, notably the small, very dense and hard spikes suggesting calathia of some *Centaurea*, and the membranous, faintly nerved, externally glabrous calyx. It differs in being glabrous below the flowers, in the fewer, acute leaflets, and in the internally white-silky bracts. While the calyx is similar to that of *D. lumholtzii*, its orifice is less oblique, not so deeply scooped out and recessed behind the banner. Notable features of the flower are a short-clawed banner and relatively low-perching epistemonous petals.

IIIA (ii). Series LAEVIGATAE

Herbaceous, glabrous below the flower-spikes; *stems* prominently angulate by ribs decurrent from the leaf-spurs; *terminal leaflets* stalked beyond the last pair; *epistemonous petals* perched ± half-way between the hypanthium and the anthers, at or immediately below separation of the filaments, these deeply divided into a tassel as long as the column; *petals* either white (the banner faintly rubescent) or (*D. pringlei*) pink to vivid magenta purple; spp. 3; Sierra Madre Occidental, mostly on the Pacific slope, s. to w. Jalisco, n. into s.-w. United States.

Dalea subgen. **Dalea** sect. **Thornbera** ser. **Laevigatae** Barneby, ser. nov., a ser. *Thornbera* caulibus angulatis, pube infra spicas nulla, foliolis terminalibus solitariis nec ternatis absimiles. — Sp. typica: **D. grayi** (Vail) L. O. Wms. (*D. laevigata* Gray).

12. DALEA GRAYI (Vail) L. O. Williams
(Plate XXXVII)

Perennial herbs from a woody root and finally a short caudex, glabrous below the spikes, (3) 3.5–7 (9) dm tall, the erect or commonly assurgent, angulately ribbed, glandless or remotely and minutely punctate, pale green or later stramineous but not or obscurely pruinose stems paniculately branched from near the middle, the spikes terminating all branches, the sparse foliage green, the thick-textured leaflets punctate beneath; *leaf-spurs* 0.4–0.9 mm long; *stipules* narrowly subulate, 0.4–1.3 mm long, rigid, yellowish; *intrapetiolular glands* obsolete; *post-petiolular glands* small, common-

ly impressed; *leaves* 1–5 cm long, shortly petioled, with narrowly margined, commonly punctate rachis and (5) 8–21 pairs of elliptic-oblanceolate to narrowly obovate, acute, obtuse, or obtuse and mucronulate, loosely folded leaflets 1–4.5 (5.5) mm long, these usually ascending along the rachis; *peduncles* 0.5–5 (10) cm long; *spikes* dense but not conelike, narrowly conic-ovoid to cylindroid, or the smallest remaining subglobose, without petals 7–9 mm diam, the densely villosulous axis becoming (0.4) 0.7–5.5 (7) cm long; *bracts* persistent (falling with the fruit), rhombic-obovate to ovate- or lance-acuminate, (2.2) 2.5–4.5 mm long, 0.8–1.4 mm wide, rather firm, shallowly boat-shaped, densely ciliolate, all but the lowest pubescent dorsally, brownish to livid and purple-glandular distally; *calyx* densely silky pilosulous, 3.6–4.8 (5.2) mm long, the tube 2–2.7 mm long, its orifice subsymmetrical, the orange-brown ribs becoming prominent, the membranous intervals charged with one row of 3–6 small, pale yellow glands, the triangular, shortly acuminate-aristate teeth 1.3–2.4 (3.2) mm long, shorter than, equalling, or exceptionally a trifle longer than the tube; *petals* white, the faintly greenish blade of the banner finally rubescent, the epistemonous petals perched at or up to 0.5 mm below separation of the filaments, the inner pair free from the first; *banner* 4–5.7 mm long, the claw 2.4–3.2 mm, the rhombic-ovate to deltate-cordate blade 1.6–2.5 mm long, 2–2.4 mm wide; *wing-* and *keel-petals* subhomomorphic but the inner pair sometimes a trifle wider and more oblique, the oblong, oblanceolate, or obliquely obovate blades 2.2–3.1 mm long, 0.8–1.4 mm wide, contracted at base into a claw 0.2–0.5 mm long; *androecium* 10-merous (one stamen sometimes barren) 5.5–7 mm long, the filaments free for 2.7–4 mm, the connective gland-tipped, the pale yellow anthers 0.55–0.7 mm long; *pod* triangular-semiobovate in profile, 2.2–2.5 mm long, the style-base terminal, the prow prominent, somewhat thickened, the valves hyaline at base, thinly papery, villosulous and finely gland-sprinkled distally; *seed* (little known) ± 1.6 mm long; $2n = 7_{II}$ (Mosquin).—Collections: 31 (ii).

Open slopes and stony flats in oak-pine or oak woodland, e.- and n.-ward coming out into grama grassland of the foothills, 780–2160 m (2600–7200 ft), locally common along the e. slope and crest of Sierra Madre Occidental from headwaters of Rio de Ramos in Durango (mpos Santiago Papasquiaro and Sta. Catarina de Tepehuanes) n. through Chihuahua to s.-e. corner of New Mexico (Grant and Hidalgo cos.), w. rather abundantly to headwaters of the Gila River in s.-e. and (one station) e.-centr. Arizona (Natanes Plateau, Gila County), more rarely across the Sierra Madre divide to scattered stations on the Pacific slope in n. and s. Sonora (Rios Santa Cruz and Bavispe; Rio Mayo) and centr. Sinaloa (Sa. Surutato and Cerro Colorado, near 25° 10–50′ N).—Flowering June to December.—*Representative*: ARIZONA: *Maguire 13,058* (NY, UC); *Jones 24,898* (NY, POM); *Barneby 5140* (NY); *Lemmon 2672* (UC). NEW MEXICO: *Metcalfe 684* (NY, US); *Bigelow 228* (NY). SONORA: *S. S. White 2686* (MICH); *Gentry 503 Mb* (MICH). CHIHUAHUA: *S. S. White 2579* (ARIZ, MICH); *Townsend & Barber 283* (F, MEXU, NY, Z); *Pringle 642* (BR, F, NY, W); *Ripley & Barneby 13,889* (CAS, NY, US); *Gentry 8240* (MEXU, UC, US). DURANGO: *Mosquin 6889* (NY); *Palmer 283* (C, F, GH, NY, UC). SINALOA: *Gentry 5180* (NY); *Breedlove 16,976* (NY).

Dalea grayi (Vail) L. O. Wms., Ann. Missouri Bot. Gard. **23**: 450. 1936, based on *Parosela grayi* (Asa Gray, 1810–1888) Vail, Bull. Torrey Club **24**: 14. 1897, a legitimate substitute for *Dalea laevigata* (smooth) Gray, Pl. Wright. **2**: 38. 1853.—"On the Chiricahui Mountains, and on the Barbocomori, Sonora [now Arizona]; Aug., Sept. (989)."—Lectoholotypus, collected in 1851 by Charles Wright, GH! isotypus, NY! paratypus, *Thurber 944* from Sta. Cruz, GH!—Non *Dalea laevigata* S. & M. ex G. Don, 1832.—*Parosela grayi* (Vail) Rydb., N. Amer. Fl. **24**: 119. 1920.

Through the large part of its range lying along the east slope and crest of Sierra Madre from central Durango into southeastern New Mexico, and west of the divide in southern Arizona and adjoining Sonora, *Dalea grayi* is the only white-flowered member of its group. A plant of modest stature (rarely over 6–7 dm tall), it is easily recognized by the combination of sparsely leafy stems, many small leaflets of thick texture ordinarily displayed at a narrow angle to the rachis, and softly pilosulous spikes of small, fleeting flowers of characteristic *Thornbera* structure. In Arizona and adjacent Sonora its range overlaps that of *D. pringlei* var. *pringlei*, distinguished by relatively long calyx-teeth, vivid magenta-purple petals, and leaflets of prevailingly broader, blunter type. It is only on the west slope of the Sierra, at moderate altitudes, where the ranges of *D. grayi, D. revoluta*, and complex forms of *D. pringlei* coincide in range, that problems of identification are likely to arise in practice. Generally, however, *D. revoluta* may be distinguished immediately by its fewer, very narrow leaflets, while sympatric varieties of *D. pringlei* that are white-flowered have virgate stems over a meter tall. For details see discussion of the next two species following.

13. Dalea revoluta Watson
(Plate XXXVII)

Herbaceous, perennial sometimes flowering the first season, (2.5) 3–7 dm tall, glabrous to the spikes, the diffuse or assurgent, green or purplish, angular-ribbed, copiously punctate or micro-tuberculate stems openly branched above the middle, the spikes terminal to all the branches, the foliage sparse, green, the leaflets punctate beneath; *leaf-spurs* 0.5–1.3 mm long; *stipules* narrowly subulate-aristiform, brown or purplish, 0.8–2.4 mm long; *intrapetiolular glands* impressed, sometimes minute; *postpetiolular glands* small, impressed or barely prominent; *leaves* 1.5–3 (3.5) cm long, shortly petioled, with narrowly margined rachis and (2) 3–9 pairs of linear to linear-elliptic, gland-mucronulate but either acute or emarginate, usually closely involute leaflets 2–8 mm long; *peduncles* 1–10 cm long; *spikes* dense, narrowly oblong-cylindroid, without petals 6–9 cm diam, the pilosulous axis becoming 1–3.5 cm long; *bracts* persistent, ovate-acuminate, -caudate, or rarely lance-acuminate, 1.5–4.5 mm long, the lowest glabrous dorsally, the rest pilosulous up to the middle or throughout, the distal half livid, gland-tuberculate, ciliate or ciliolate; *calyx* 2.9–4.2 (4.7) mm long, pilosulous with hairs up to 0.2–0.8 (1) mm long, the tube 1.6–2.1 mm long, its orifice subsymmetrical, the subfiliform ribs brownish-purple or pallid, not very prominent, the intervals membranous, eglandular, the triangular-acuminate or shortly aristate, entire teeth 1–2.4 (2.8) mm long, half as long up to 0.9 mm longer than the tube; *petals* white, eglandular, the banner rubescent, the epistemonous ones perched at or slightly below half-way betwen hyapnthium and anthers but at or close under separation of the filaments, all free; *banner* 3.8–5.1 mm long, the claw 1.8–2.9 mm, the ovate-cordate to deltate blade 2–2.3 mm long, 1.8–2.7 mm wide; *wing* and *keel-petals* similar, but the latter often a little shorter, proportionately broader, and more oblique at the incipiently auriculate base, the claw 0.2–0.5 mm, the oblanceolate to obovate blades 2.1–3.3 mm long, 1–1.5 mm wide; *androecium* (7) 9–10-merous, 6–7.5 mm long, the column 2.5–3.5 mm, the tassel 3.2–4 mm long, the connective gland-tipped, the yellow anthers ± 0.6 mm long; *pod* apparently as in *D. grayi*, not seen ripe.—Collections: 18 (4).

About thickets, along roads, and in open grassland, mostly 450–1350 m (1500–4500 ft), s.-ward ascending into the oak-belt and up to 2200 m (7300 ft), apparently local but locally plentiful along the w. slope and piedmont of Sierra Madre Occidental from s. Sonora and adjoining Chihuahua, especially on Río Mayo, s. through Sinaloa to the valley of Río Piaxtla (lat. 24° N); apparently disjunct in the canyons of Ríos

Santiago and Bolaños in n.-w. Jalisco but to be sought and expected in s. Sinaloa and Nayarit. — Flowering September to March. — *Representative*: SONORA: *C. E. Lloyd 383* (GH, NY, UC); *Gentry 771* (ARIZ), *1104* (F, GH), *1428* (ARIZ, MEXU, UC); *Gentry, Barclay & Arguelles 19,311* (US), *19,396* (US). SINALOA: *Gentry 5187* (ARIZ, MEXU); *Ortega 460* (MEXU), *723* (ENCB, F). JALISCO: *Rzedowski 17,683* (ENCB, TEX, MEXU); *Pringle 2493* (BR, F, M, MEXU, NY, SD, W, Z), *11,425* (ARIZ, F, L, MEXU); *Ripley & Barneby 14,058* (CAS, NY, US).

Dalea revoluta (folded backward, a misnomer) Wats., Proc. Amer. Acad. **22**: 404. 1887. — "Guadalajara, among bushes; September. (496)." — Holotypus, collected in 1886 by Edward Palmer, GH! isotypi, NY, US! — *Parosela revoluta* (Wats.) Rose, Contrib. U. S. Nat. Herb. **10**: 105. 1906. *Thornbera revoluta* (Wats.) Rydb., N. Amer. Fl. **24**: 119. 1920.

The specific epithet *revoluta* was poorly chosen for this rather weedy and inconspicuous dalea, the leaflets being involute, as common in the genus, but never revolute. It is closely related to *D. grayi*, which it resembles in the white petals and in the form of the flower-spikes, but differs in having commonly fewer and proportionately narrower leaflets, filiform or nearly so, spreading from the rachis and often gently incurved. Over the greater part of its known range *D. revoluta* is reasonably distinct, but on the Chihuahua-Sonora border, at the west edge of the range of *D. grayi*, there are puzzling populations, suggesting that these two species may not be genuinely discrete entities. Gentry's plant from La Mesa Colorada (s. n., 1933, ARIZ), and others from Sierra Surutato, Sinaloa (*Breedlove*, NY) with up to 14 pairs of leaflets but a calyx lacking glands in the intervals of the calyx, are ambiguous. In the same general area *D. revoluta* and *D. pringlei* are sympatric, but the varieties of the latter present in the Río Mayo drainage and vicinity either have purple petals or tall, erectly virgate stems a meter long or more, or in the rare event of the petals being white are more readily distinguished by very numerous (14–26 pairs) leaflets in main cauline leaves.

Southward from this critical area, where field-studies are required to solve unanswerable problems posed by the material now available, the documented range of *D. revoluta* is discontinuous and there is some evidence of geographic differentiation. In Jalisco the calyx-teeth are short, ± 1–1.5 mm long, and the bracts have dorsally naked tips. In Sonora and Sinaloa the teeth tend to be longer (mostly 2–2.5 mm) and the whole flower-spike tends to be more densely pubescent with longer hairs, the vesture commonly extending out to the tip of the interfloral bracts. A short-toothed but long-pilosulous calyx is found in one collection from Sinaloa, however, and the variation may well turn out, as the gaps in the range are filled in, to be clinal in nature and much less abrupt than now appears.

In southern Sonora Gentry found *D. revoluta* in good repute as a source of honey; it is known there as *Popote chiquita*, so distinguished from the true *Popote* which is *D. pringlei*.

14. DALEA PRINGLEI Gray
(Plates XXXVIII and XXXIX)

Perennial, herbaceous or in age weakly suffruticulose, glabrous up to the silky-pilosulous flower-spikes, variable in stature, the prominently angulate-ribbed, pale-green, rarely purplish, in age often pruinose-glaucescent, minutely and remotely punctate stems either several, assurgent or diffuse, and ± 2–10 dm tall, or 1–few, erect, virgate, and sometimes reaching 2.5 m, simple only when very short, commonly branched upward from the middle or at least distally, the spikes terminal to all branchlets, the foliage green or subglaucescent, the leaflets smooth above, punctate beneath;

stipular spurs 0.5–1.4 mm long; *stipules* narrowly subulate, rigid or even subspinulose in age, 0.5–2 mm long; *intrapetiolular glands* obsolete; *post-petiolular glands* minute, impressed; *leaves* 1.5–8 cm long, shortly but distinctly petioled, with narrowly margined, sparsely punctate rachis and few to many pairs (3–33, according to variety) of leaflets 1–15 mm long, variable in shape; *peduncles* 1–6 cm long; *spikes* narrowly ovoid becoming or from the first cylindroid, relatively loose, including bracts but without petals 8–12 mm diam, the villosulous axis becoming (1) 1.5–14 cm long; *bracts* persistent, subdimorphic, the lowest broadest, mostly ovate, the rest more narrowly ovate- to lance- or elliptic-acuminate, 2.5–5.5 mm long, always densely ciliolate and glabrous within, variably pubescent dorsally but in the distal half glandular, commonly fuscous or livid, sometimes green; *calyx* (3.5) 4.3–6.1 (6.5) mm long, densely silky-pilose externally, the tube 1.7–2.5 (2.7) mm long, its orifice subsymmetrical, the ribs prominent but slender, orange-brown, the membranous intervals charged with one row of 3–6 (7) small, honey-colored glands, the triangular-acuminate or shortly aristate, entire teeth commonly 2.4–4 (in var. *oxyphyllidia* only 1.4–2) mm long, plumose; *petals* most commonly bicolored with white to ochroleucous (but rubescent) sometimes lilac-tipped banner and epistemonous ones pink-purple or vivid magenta, the latter sometimes pale or white, these perched almost at or up to 1.2 mm below separation of the filaments; *banner* 3–5.1 mm long, the claw 1.7–3.4 mm, the deltate-cordate or rhombic-flabellate blade 1.2–2 mm long, 1.2–2.4 mm wide; *wing* and *keel-petals* similar but the inner pair sometimes a trifle shorter, wider, and more oblique, (1.8) 2–3.1 mm long, the claws 0.1–0.5 mm, the oblanceolate-obovate blades cuneate at base, 1.7–2.6 mm long, 0.8–1.5 mm wide; *androecium* 10-merous, 5.5–7 mm long, the filaments free for 2.2–3.2 mm, the connective gland-tipped, the yellow anthers 0.5–0.6 mm long; *pod* as in *D. grayi*, 2.5–3 mm long; *seed* (little known) 1.7–2.2 mm long.

From the time of their discovery and first description *D. pringlei* and *D. grayi* have been recognized as near kindred, and as their ranges of morphological variation have expanded along with knowledge of their narrowly overlapping ranges, it has become increasingly difficult to separate them in absolute terms. In Arizona, where they have been found close together even though properly belonging to different altitudinal strata in the foothills, *D. pringlei* being adapted to more xeric conditions that its relative, they can be told apart by the color of the epistemonous petals, always vivid purple in *D. pringlei* and white in *D. grayi*. Here also the calyx-teeth of *D. grayi* are substantially shorter in relation to the tube than those of *D. pringlei*. The mature spike of *D. pringlei* becomes moderately loose, so that flowers of pressed specimens tend to fall into two or three ranks and expose parts of the axis, which is concealed by crowded flowers in a comparable spike of *D. grayi*. In most cases the bracts of *D. grayi* are narrower than those of *D. pringlei*, 0.8–1.2 rather than 1.2–2 mm wide, but there is some overlapping in this character. In northern Mexico *D. grayi* becomes more variable and individual plants, although always white-flowered, may have relatively loose spikes, calyx-teeth (rarely) as long as the tube, or broad bracts; however I have not seen these characters together on one plant. Along the state line dividing southern Sonora from Chihuahua *D. pringlei* is represented by a series of giant forms with wandlike stems bearing long, sometimes relatively dense flower-spikes, the epistemonous petals varying at the same time from bright purple to pale pink or rarely white. But the white-flowered forms, sometimes mistaken in the past for *D. grayi*, have the characteristic calyx and bracts of *D. pringlei*. One very local form, recognized below as *D. pringlei* var. *oxyphyllidia*, combines in one plant a short-toothed calyx similar to that of *D. grayi* with purple petals. This variety, further distinguished from both typical *D. pringlei* and *D. grayi* by the relatively few pairs of large leaflets, has the wandlike growth-form of

nearly sympatric *D. pringlei* var. *multijuga*. An extraordinary fund of variation in *Thornbera* is concentrated about the Conchos-Urique divide in western Chihuahua, and as exploration of this inaccessible and botanically little known region progresses, the problem of interspecific relationships in ser. *Laevigatae* may well need reappraisal.

It can now be seen that the type-collection of *D. pringlei* was from the edge of the species-range and is also morphologically marginal. The populations of *D. pringlei* in Arizona flower both in late summer (August–November) following summer rains and again, perhaps more reliably, in spring (February–May) as the temperatures rise and the days get longer. In most years the vernal form, to which the nomenclatural typus belongs, is a lowly, drought-inhibited plant, commonly with several stems up to ± 6 dm tall; the leaves developing with or soon before the flowers are relatively short and simple, with some 5–10 pairs of leaflets. The autumnal (exceptionally, in wet years, also vernal) phase develops somewhat taller stems that bear longer primary leaves composed of more numerous (up to 19, exceptionally 25) pairs of leaflets. It is not known that these two seasonal aspects occur in the same place, but I suppose this to be the case. In southern Sonora and Chihuahua, where *D. pringlei* is represented by the tall vars. *oxyphyllidia* and *multijuga*, no vernal phase is on record. Here the plants flower in autumn and winter, mostly from October into early March, by which time they are passing into summer dormancy and even though still bearing a few flowers have lost all but a few small upper leaves. The complicating factor of seasonal dimorphism in *D. pringlei* makes a concise, consistently useful key to its varieties almost unattainable.

Key to the Varieties of *Dalea pringlei*

1. Stems at anthesis (1.5) 2–6 (8) dm tall, usually several from a branching caudex; *leaves* 1.5–4.5 (5.5) cm long, the lateral leaflets commonly either less than 14 pairs, or obtuse, often both; *principal spike* of each stem 1–7 (9) cm long; *bracts* villosulous dorsally over whole surface; *petals* all or all but banner purple and calyx-teeth (2.5–4 mm) longer than the tube; s.-e. Arizona and n. Sonora. 14a. var. *pringlei*.

1. Stems at anthesis 0.7–2.5 m tall, usually solitary or few from each root; *leaflets* acute or, if obtuse then apiculate, variable in number; *spikes* and *calyx* variable; *bracts* glabrate dorsally above the middle; *petals* magenta, pink, or white.
   2. Leaflets of main cauline leaves 14–32 pairs, mostly small, 1–5 (7) mm long; *spikes* central to each stem 4–14 cm long; *calyx-teeth* 2.2–4 mm long; *petals* magenta, pink, or white; s.-w. Chihuahua, s. Sonora, and n. Sinaloa, relatively widespread. 14b. var. *multijuga*.
   2. Leaflets of main cauline leaves 3–8 pairs, relatively large, 3–7 mm long; *spikes* short and compact, 2–5 cm long; *calyx-teeth* less than 2 mm long; *petals* magenta-purple; very local on Río Mayo, s. Sonora (Sierras Saguaribo and Tecurahui). 14c. var. *oxyphyllidia*.

14a. Dalea pringlei Gray var. pringlei
(Plate XXXVIII)

Characters as given in key; *spikes* mostly (1) 1.5–6.5 cm long; n = 7 (Spellenberg, 1973). — Collections: 20 (o).

Rocky hillsides and boulder-strewn washes in the foothills around the n.-e. margins of the Sonoran Desert, in cactus-thornscrub, ± 800–1000 m (2700–3330 ft), almost

entirely within the Arizona Upland (Shreve & Wiggins, 1964), in s.-centr. Arizona (Rincon-Santa Catalina, Tucson, Santa Rita, Baboquivari, Chiricahua, and Mule mts. in Pima, Cochise, and doubtless Santa Cruz counties) s. in Sonora to the upper valley of Río Sonora (mpos. Sta. Ana Baviacora and Urés). — Flowering August–November, February–May. — *Representative*: ARIZONA: *Pringle* (Sta. Catalina Mts.) *in 1883* (NY, UC); *Shreve 10,202, 10,216* (UC); *Thackrey 12* (NY). SONORA: *Wiggins 7234* (ARIZ, UC); *Drouet & Richards 3629, 3730* (F); *R. & M. Spellenberg 3051* (NY).

Dalea pringlei (Cyrus Guernsey Pringle, 1838–1911) Gray, Proc. Amer. Acad. **17**: 201. 1882 ("*Pringlei*"). — "Foot-hills of the Santa Catalina Mountains, S. Arizona, *Pringle*, April and May, 1881." — Holotypus, GH! isotypi, NY, US! — *Parosela pringlei* (Gray) A. Heller, Catal. N. Amer. Pl., ed. 2, 6. 1900. *Thornbera pringlei* (Gray) Rydb., N. Amer. Fl. **24**: 119. 1920.

14b. DALEA PRINGLEI var. MULTIJUGA Barneby
(Plate XXXVIII)

Characters as given in key; *leaflets* elliptic, all or all but the terminal one acute or subacute. — Collections: 12 (o).

Hot brushy hills, ascending on dry open ridges into the pine-oak belt, mostly 150–1500 m (500–5000 ft), apparently local, foothills and piedmont of Sierra Madre Occidental on Ríos Mayo and Verde in extreme s.-e. Sonora and adjoining Chihuahua, s. to Sierra Surutato in n. Sinaloa; an old record from the coast of Sonora at Guaymas to be confirmed. — Flowering October to March. — *Representative*: SONORA: *Gentry 1097* (F), *1444* (F, UC), *4840* (ARIZ, NY), *4890* (ARIZ), *8009* (ARIZ, MEXU, MICH, UC), *8113* (MEXU, UC), *11,597* (MICH). CHIHUAHUA: *Goldman 239* (GH, NY). SINALOA: *Gentry 7165* (GH).

Dalea pringlei Gray var. **multijuga** (with many pairs of leaflets) Barneby, var. nov., a var. *pringlei* caulibus elatis valde pruinosis pallidis, foliolis numerosis foliorum majorum 12–26-jugis, spicis majoribus elongatis, bracteisque dorso ultra mediam glabratis diversa. — CHIHUAHUA: "Southwest Chihuahua," April–November 1885, *Edward Palmer 241*. — Holotypus, NY; isotypus, MEXU. — According to McVaugh, 1956, p. 91, 146, 310, the type-locality should be at Hacienda San Miguel near Batopilas, 27° 01′ N, 107° 38′ W, where var. *multijuga* was later encountered by E. A. Goldman.

The material of var. *multijuga* from Chihuahua has vivid magenta epistemonous petals like those of var. *pringlei*, whereas in the Río Mayo region, in s. Sonora, they are white or faintly pink-tinged. It was for this reason, no doubt, that Gentry (1942, p. 138) misidentified several collections from Río Mayo (Sierra La Chuna; Guajaray; Sierra de Alamos) as *D. grayi*, distinguishing the purple-flowered plant from Sierra Saguaribo (our var. *oxyphyllidia*) as probably distinct. Gentry records that both these tall, wandlike daleas are known in southern Sonora as *Popote*, the stems of var. *multijuga* being brought down from the hills for use as brooms.

While much of what is known of the range of var. *multijuga* is based on the superb and ample collections of H. S. Gentry, credit for its discovery goes back to the botanists of the Spanish Royal commission in New Spain, late in the XVIII century. Specimens of the purple-flowered type are found in the Sessé & Mociño herbarium (*no. 2671*, F, MA) under the epithet "*microphylla*", but apparently were not among the daleas sent to Lambert by Pavón and subsequently described by George Don. At least, I have not been able to associate any of the yet unidentified species of Don with *D. pringlei*.

Because the documented range of var. *multijuga* lies along the piedmont of the Sierra Madre, I am inclined to look with scepticism on the label of *Palmer 667*, ostensibly collected at Guaymas. McVaugh (1956, p. 323) records that Palmer made a trip inland from Guaymas to the Yaqui river in November-December 1869, and I speculate that the plant may actually have been encountered somewhere in the interior.

14c. Dalea pringlei Gray var. oxyphyllidia Barneby
(Plate XXXIX)

Characters as given in key. — Collections: 3 (o).

Oak or oak-pine woodland, 900–1350 m (3000–4500 ft), apparently very local, known only from Sierras Tecurahui and Chiribo (Saguaribo), mpo. de Alamos, s.-e. Sonora, close to the Chihuahua state line (near 27° 20′ N) and to be expected on the e. slope draining to Río Fuerte within Chihuahua. — Flowering October to March. — *Material*: Sonora. Alamos: Sierra Tecurahui (typus); Sierra Saguaribo, *Gentry 1409* (F,), *Gentry, Barclay & Arguelles 19,309 (US).*

Dalea pringlei var. **oxyphyllidia** (with sharp-pointed leaflets) Barneby, var. nov., inter varietates supra descriptas quasi intermedia, var. *pringlei* spicis breviusculis foliolisque paucis (3–9-jugis), var. *multijugae* statura elata, foliolis acutis, anthesique serotino similis, ab illa foliolis subduplo longioribus acutis nec apice rotundatis vel emarginatis, ab hac foliolis 3–8 (nec 14–33)-jugis et caulibus viridibus nec pruinosis, ab ambabus dentibus calycinis abbreviatis, dorsali 1.4–1.8 (nec 2.2–4) mm longo abstans. — Sonora: in pine-oak forest, 4000–4500 ft., Sierra Tecurahui, October 26–28, 1961, *Gentry, Barclay & Arguelles 19,426.* — Holotypus, US; isotypus, RENNER.

Although the highly restricted known range of var. *oxyphyllidia* is contained within that of var. *multijuga* it appears sharply distinct in its few leaflets, short spikes, and short-toothed calyx. Vivid purple epistemonous petals do occur in var. *multijuga*, but only in populations distantly allopatric from var. *oxyphyllidia*, the populations on Río Mayo and its affluents being white- or faintly pink-flowered. The presence on Sierra Tecurahui of a second member of sect. *Thornbera*, described above as *D. ananassa*, is the more remarkable because the two are much alike in habit and foliage, really more like each other than each is to its presumed close relatives, referred herein to ser. *Laevigatae* and *Albiflorae* respectively. One might imagine that *D. lumholtzii* and *D. pringlei* var. *multijuga* have contributed to the genetic structure of these two daleas of Sierra Tecurahui, but this would not explain the low number of leaflets common to both, or the unique, internally silky bracts of *D. ananassa*, or reappearance of the latter on Sierra Surutato in Sinaloa.

IIIA(iii). Series Nelsonianae Barneby

Calyx glabrous externally, becoming subtumid and ellipsoid, deeply cleft behind the banner, the membranous intervals charged with many small glands arranged in 2–3 ranks; *petals* blue and white; *stipules* elongate, linear-caudate. — Monotypic; pine-belt of Sierra Madre Occidental in Chihuahua and Durango.

Dalea subgen. **Dalea** sect. **Thornbera** ser. **Nelsonianae** Barneby, ser. nov., a ser. *Thornbera* imprimis calycis subtumidi membranacei lucidi tubo extus glabro post vexillum profunde fisso, utroque intervallo intracostali glandulis numerosis 2–3-seriatis consperso abstans. — Sp. unica: **D. nelsonii** (Rydb.) Barneby.

The perennial root, the form and insertion of the petals, and the deeply cleft tassel of free filaments are typical of sect. *Thornbera,* but the calyx, strongly suggesting that of sect. *Dalea* ser. *Urceolatae*, is unique in the section. The slenderly caudate stipules are an unusual feature in sect. *Thornbera*, but are sometimes nearly matched in the variable *D. albiflora*. Late in the season the caudex of *D. nelsonii* sometimes develops delicately leafy innovations composed of many tiny leaves, a common occurrence in the related *D. lumholtzii*. Despite the similarity in the calyx, a close relationship to the annual *Urceolatae* seems unlikely.

15. Dalea nelsonii (Rydberg) Barneby
(Plate XXXIX)

Perennial, herbaceous or weakly suffrutescent, from a woody root and short caudex, glabrous to the spikes, the diffuse and radiately ascending, chestnut-purple (rarely green) stems (3.5) 4–9 dm long, verruculose throughout with many small, round, orange or purple glands, simple at base, paniculately branching from near or above the middle, the foliage green, the leaflets punctate beneath (the glands rarely visible from above), their margins commonly purplish; *leaf-spurs* 0.6–1.5 mm long; *stipules* narrowly linear-caudate, 3–8 mm long, livid, sparsely glandular; *intrapetiolular glands* 2, minute; *post-petiolular glands* conic, prominent; *leaves* 1.5–4.5 (5) cm long, shortly petioled or subsessile, the rachis very narrowly margined, the leaflets 9–18 pairs, elliptic to narrowly elliptic-oblanceolate, minutely emarginate, keeled dorsally, involute or loosely folded, 1–6.5 mm long; *peduncles* terminal to the main axis and to all its branches, 1–11 cm long; *spikes* dense, narrowly conic becoming cylindric, without bracts or petals 8–14 mm diam, the glabrous or puberulent axis becoming (1) 1.5–9 cm long; *bracts* persistent, narrowly lance-caudate, 3–6.5 mm long, livid, sparsely glandular, all glabrous or the upper ones thinly pilosulous dorsally, the lowest sometimes minutely ciliolate at base; *calyx* 3.7–4.9 mm long, early becoming a little tumid and oblong-ellipsoid, glabrous except for a few weak, spiral hairs distally but the teeth silky-pilose within and the mouth therefore ciliate, the tube (measured to a dorsal sinus) 2.5–3.6 mm long, deeply recessed behind the banner, the ribs subfiliform, livid-nigrescent, the membranous, plane intervals charged with many small, yellowish blister-glands arranged in ± 2–3 vertical ranks, the livid, subulate or triangular-subulate teeth unequal, the dorsal one longest and narrowest, 0.8–1.6 mm long, the ventral pair broader and commonly shorter; *petals* bicolored, bright lavender-blue and white, the banner white with blue tip, the white part rubescent in age, all eglandular, the epistemonous ones perched just below, or the inner pair a trifle above separation of the filaments, about half-way between hypanthium and anthers; *banner* 5–7.8 mm long, the claw (2) 2.8–4 mm, the ovate, shallowly emarginate, almost erect blade 2.9–4.3 mm long, 2.2–3.8 mm wide; *epistemonous petals* 3.5–5.1 mm long, all alike but the inner pair sometimes a little larger, the blades elliptic-oblanceolate to oblong-obovate, 2.9–4.2 mm long, 0.8–1.9 mm wide, obliquely contracted at base into a claw 0.6–1 mm long; *androecium* 10-merous, (5.3) 6–8.5 mm long, the filaments free for (2.8) 3–4.2 mm, the connective gland-tipped, the pale yellow anthers 0.45–0.55 mm long; *pod* 2.5–2.8 mm long, obovoid in profile, the short style-base latero-terminal, the ventral crest and prow very slender, the valves hyaline except at the thinly herbaceous, green, sparsely microglandular tip; $2n = 7_{II}$ (Mosquin). — Collections: 8 (ii).

Open stony and grassy hillsides in oak-pine forest, sometimes on volcanic tuff, 1800–2460 m (± 6000–8200 ft), local but forming colonies, on and near the crest

of Sierra Madre Occidental from the headwaters of Río Verde in s.-w. Chihuahua (± 26° 20′ N) s.-w. to the sources of Río Acaponeta in w. Durango (± 24° 45′ N). —Flowering August to November. —*Material*: CHIHUAHUA. Balleza: Sierra Chinatú, *Correll & Gentry 22,952* (RENNER). Guadelupe y Calvo: Nabogame, *Gentry, Correll & Arguelles 17,972* (RENNER, US). DURANGO. —*P. Ibana García 370* (US). Ciudad Durango: 38 mi w. of Durango, *Ripley & Barneby 13,961* (CAS, DAO, NY, MEXU, MICH, US); 51 mi. w., *Ripley & Barneby 14,003* (NY); 24 mi. e. of El Salto, *Mosquin 6828* (NY); 22 mi n.-e. of El Salto, *G. & F. Ownbey 2001* (MICH).

Dalea nelsonii (Rydb.) Barneby, comb. nov., based on *Thornbera nelsonii* Rydb., N. Amer. Fl. **24**: 120. 1920 ("*Nelsonii*"). — "Type collected sixty miles south of Guadelupe y Calvo, Chihuahua [perhaps really south of the state line in Durango], August [20], 1898, *E. W. Nelson 4790...*" — Holotypus, US! isotypus, NY!

This is a relatively showy and decorative dalea, the only blue-flowered species of the *Thornbera* type known to occur in its short segment of the Sierra Madre. The warty, usually castaneous stems of the adult plant are numerous and freely branched, radiating from a short caudex and fringed all around the loose-woven mat of foliage with a multitude of tasselled spikes. Although the individual flower is small, several successive ranks of them bear expanded petals, older or younger, at the same time, forming a band of color around the spike of calyces. West of Durango *D. nelsonii* shares the pine-oak forest with the habitally similar *D. cyanea*, a species coincidentally similar in its blue or blue and white petals and asymmetrically cleft calyx-tube, but readily distinguished by its flower of the parosela type, with anthers concealed in a conventional keel, or if these are past by the few (4–8, not 9–18) pairs of leaflets.

In the accompanying plate the petal-sockets are shown (fig. 10) in their usual situation, just a trifle below the point of separation of filaments. There is some variation, however, in the depth of the filament tassel, the sinuses sometimes being recessed back up to 0.2 mm below the sockets so that the petals seem to issue from little eminences on the back of alternate stamens.

IIIA (iv). Series RUBROLUTEAE Barneby

Calyx glabrous except for the ciliolate orifice, subtumid, the tube not recessed behind the banner, the lustrously membranous intervals charged with few large glands arranged in one rank, the teeth transversely half-circular, broader than long; *petals* yellow, gland-tipped; *stipules* small, firm. — Monotypic; Gulf slope in Oaxaca.

Dalea subgen. **Dalea** sect. **Thornbera** ser. **Rubroluteae** Barneby, ser. nov., inter affines sectionis suae calycis extus glabri lucidi tubo subtumido sed post vexillum haud retroscisso, dentibus valde abbreviatis, necnon petalis luteis parvulis vix exsertis praestantes. — Sp. unica: **D. rubrolutea** Barneby..

Up to its unique flower *Dalea rubrolutea* is an unexceptional member of the genus, remarkable only for the abundance of glands on stem and leaf and for the extremely fine and short pubescence. The flask-shaped calyx, lustrously hyaline and charged between the ribs with several large, orange blister-glands, recalls that of *D. viridiflora*, as do the yellow coloring of the gland-tipped petals and the exserted anthers. The epistemonous petals of these two species are, however, quite different, those of *D. rubrolutea* being essentially, both in form and position, the petals of sect. *Thornbera*, whereas the organization of the flower in *D. viridiflora* is (with the exception of the exserted anthers) of the conventional parosela type. In the context of *Thornbera, D. rubrolutea* occupies an isolated position, no other member of the section having yellow petals or a calyx like it in

all particulars. The calyx of *D. nelsonii* is similar insofar as the tube is incipiently tumid, lustrous, and externally glabrous, but it is deeply cleft behind the banner and ornamented in the intercostal membranes by very numerous, small and scattered glands. Geographically *D. rubrolutea* stands well apart from other members of sect. *Thornbera*, a group concentrated, with the one exception of *D. elata*, along the west rim and scarp of the Meseta Central. The pod of *D. rubrolutea*, when discovered, may conceivably suggest a new alignment for the species.

16. DALEA RUBROLUTEA Barneby
(Plate XL)

Herbaceous or weakly suffrutescent perennial, the apparently diffuse stems up to 6 dm long, simple and glabrous in the lower ⅓, thence paniculately branching, chestnut-purple, thinly and minutely pilosulous with curly and incurved hairs up to 0.2 mm long, verruculose throughout with prominently convex and grainlike warts, the foliage green, the lower leaves glabrate, the upper ones minutely pilosulous, the leaflets of rather thick texture, gland-dotted beneath; *leaf-spurs* 1–2 mm long; *intrapetiolular glands* small, hemispherical; *post-petiolular glands* conspicuous, mammiform; *main cauline leaves* 1.5–4 cm long, with narrowly margined, narrowly grooved rachis and 7–11 pairs of oblong, oblong-oblanceolate, or narrowly obovate, emarginate, bluntly gland-mucronulate leaflets 2.5–6.5 mm long, the uppermost leaves smaller but the smaller leaflets no less numerous; *peduncles* at first leaf-opposed then terminal to all the branchlets, 1–4.5 cm long; *spikes* densely many-flowered, ovoid becoming oblong, without petals 8–9 mm diam, the densely pilosulous axis 1–2.6 cm long, concealed by crowded calyces; *bracts* persistent, 2–3 mm long, subhomomorphic but the lowest shorter, all obovate, boat-shaped, emarginate with a very short puberulent tail (± 0.5 mm) in the sinus, the submembranous body glabrous or distally puberulent, lurid and orange-glandular dorsally, pallid-margined; *calyx* 3.8–4.2 mm long, glabrous except for the slightly constricted, scarcely oblique orifice, the subtumid tube 3.2–3.8 mm long, 1.7–2 mm diam, lustrously hyaline, orange-tinged, the slender ribs not prominent, livid-castaneous, the broad intervals charged with 1–3 large elliptic, orange blister-glands arranged in a single rank, the teeth unequal, the dorsal one shortest and narrowest, the ventral and lateral pairs broadly obovate-truncate, wider than long, ± 0.4 mm long, all charged around the apex with 3 (4) livid gland-spurs, ciliolate around the livid margins; *petals* (dry) pale yellow, all tipped with a small gland, the banner charged with a few tiny glands near the eye of the blade, the inner ones elevated ± 2–2.5 mm above the hypanthium rim (perched just below separation of the filaments), the keel petals free even in bud; *banner* 3.8–4.6 mm long, the slender claw 1.7–2.4 mm, the ovate, emarginate, nearly erect blade open at base, 2.3–2.6 mm long, ± 2 mm wide; *wing-* and *keel-petals* almost alike, the latter a trifle broader and more oblique at base of blade, 2.4–3 mm long, the claw 0.5–0.7 mm, the broadly oblanceolate to obovate-oblong blades cuneate at base, 1.9–2.3 mm long, 0.6–1.3 mm wide; *androecium* 10-merous, 3.8–5.5 mm long, the longest filament free for 1.8–2.8 mm, the gland-tipped anthers ± 0.45 mm long; *ovary* subglabrous, the terminal style bearing a few hairs at base, the *pod* unknown. — Collections: 2(o).

Habitat not recorded, supposedly found at "6500–7500 ft" (± 1950–2150 m) but from the xerophytic appearance of the plant to be sought in cactus-thorn-forest considerably lower, known only from the valley of Río Tomellín in distr. Cuicatlán, on the Atlantic slope in n.-e. Oaxaca. — Flowering November-December. — *Material*: "Mexico", without exact locality, *Karwinski 5764-5* (M). OAXACA: cf. typus.

Dalea rubrolutea (red and yellow) Barneby, nom, nov., based on *Thornbera lutea* (yellow) Rydb., N. Amer. Fl. **24**: 117. 1920. — "Type collected on the west side of the valley of Cuicatlan, Oaxaca, November 10, 1894, *E. W. Nelson 1896*..." — Holotypus, US! isotypus, NY! — Non *Dalea lutea* (Cav.) Willd., 1803. *Parosela rubricaulis* (red-stemmed) Rose ex Rydb., N. Amer. Fl. **24**: 119. 1920, in syn., hyponym. Non *P. rubricaulis* Rusby, 1910, nec *Dalea rubricaulis* Ulbr., 1915.

Although first collected by Baron von Karwinski as long ago as 1827, *D. rubrolutea* has been encountered only once since; nothing is known of its habitat, and the specimens, as often happens in *Dalea*, do not convey a clear picture of the plant's habit of growth. Plate XL couples *D. rubrolutea* with the humifuse *D. viridiflora*, superficially similar in its yellowish, gland-tipped petals issuing from a lustrously hyaline, incipiently inflated calyx, suggesting that the stems of both are prostrate; it seems as likely, however, that the relatively stiff and coarse stems of *D. rubrolutea* are virgately assurgent or erect. More collections of this isolated and peculiar monotype are needed.

IIIA (v). Series Flavae (Rydberg) Barneby

Herbaceous, sometimes suffrutescent in age, sometimes precociously flowering and appearing annual; calyx-tube subsymmetrical, pleated, the ribs thickened and prominent, the narrow, recessed intervals charged with one row of glands; *petals* very small, whitish, the caducous epistemonous ones perched about half-way between hypanthium and anthers but below separation of the relatively short tassel of filaments; *leaflets* flat and rather thin-textured, mostly 6–12, sometimes only 4–7 pairs; *stipules* narrowly subulate to setiform. — Monotypic; w. and s. Mexico.

Dalea subgen. **Dalea** sect. **Thornbera** ser. **Flavae** (Rydb.) Barneby, stat. nov., based on *Parosela* subgen. *Euparosela* XIV. *Flavae* Rydb., N. Amer. Fl. **24**: 70. 1920. — Sp. typica: *P. flava* (M. & G.) Rydb. = (syn. tax.) **D. elata** H. & A.

The taxonomic isolation of the *Flavae* was recognized by Rydberg, who misinterpreted the plants as coarse annuals and aligned them next to *D. leporina* (*Parosela alopecuroides*) and kindred. Although I am aware that *D. elata* lacks the long filament-tassel which is otherwise diagnostic of *Thornbera*, the ordinarily perennial life-span and the coarsely ribbed calyx suggest closer ties with *D. albiflora* than with any particular member of sect. *Dalea*. The species forms a link between sections *Dalea* and *Thornbera* and could with almost equal propriety be referred to either.

17. Dalea elata Hooker & Arnott
(Plate XLI)

Potentially perennial becoming suffruticose, sometimes flowering precociously and then appearing annual, variable in stature and pubescence, commonly tall and erect, sometimes low, diffuse or decumbent, at anthesis (1) 2–22 (30) dm tall, the stems simple only when very short, usually branching near and above the middle, prominently ribbed but not or only obscurely glandular, the whole plant villosulous with ascending, soft and weak hairs mostly less than 0.7 mm long or variably glabrescent below the always silky spikes but rarely truly glabrous, the foliage green or greenish, the leaflets subconcolorous or much paler beneath, gland-dotted dorsally; *leaf-spurs* 0.5–1.4 mm long; *stipules* linear-subulate to setiform, 1.5–3.5 (4) mm long, usually orange-brown or livid distally, becoming dry and fragile; *intrapetiolular glands* very small and impressed or obsolete; *post-petiolular glands* small, often impressed;

leaves (1) 1.5–5.5 (6.5) cm long, shortly petioled or subsessile, in juvenile plants all relatively short and with only 4–7 pairs of leaflets, but in taller, mature ones dimorphic, the *main cauline* with narrowly margined rachis and 6–12 pairs of elliptic, oblong-elliptic and mucronulate, to broadly oblong-obovate and obtuse, mostly flat, always thin-textured leaflets 2–12 mm long, the terminal one shortly stalked beyond and larger than the last pair, the leaves on the branchlets shorter, simpler, resembling those on the main stems of juvenile plants; *peduncles* at first leaf-opposed, then terminal to all the branchlets, 0.5–5 (6) cm long; *spikes* moderately dense, oblong-ovoid becoming cylindric or the shorter ones permanently ovoid, without androecia 8–10 mm diam, the villosulous axis becoming (1) 1.5–5.5 (7) cm long; *bracts* persistent at least through anthesis, commonly until fall of the calyx and pod, rhombic-lanceolate to narrowly elliptic, attenuate distally or at both ends, the blades greenish, brown, or livid-castaneous, prominently gland-charged, narrowly pallid-margined at base, plumose-ciliate, glabrous within, either villosulous or glabrescent dorsally; *calyx* 3.6–4.4 mm long, pilose at least at very base, always on the teeth, with fine ascending spiral hairs, the sometimes thinly pubescent or largely glabrate and lustrous tube 1.7–2 mm long, becoming strongly pleated, the prominent, thickened ribs usually yellowish, the recessed intervals narrow, membranous, charged with one vertical row of ± 2–4, sometimes irregularly confluent, black or orange (rarely pallid) blister-glands, the orifice subsymmetrical, the triangular-aristate teeth 1.9–2.5 mm long, as long or longer than the tube; *petals* whitish, drying ochroleucous, eglandular or the banner charged at apex with a minute grain, the early caducous inner petals elevated 1.8–2.8 mm beyond the hypanthium rim, the keel-parts separate even in the bud; *banner* 3.2–4.9 mm long, the slender claw 2.1–3 mm long, the deltate-cordate or reniform blade erect, open at base, 1–2.2 mm long, 1.6–2.6 mm wide; *wing-* and *keel-petals* similar in form, the latter a trifle more obviously oblique but scarcely broader, 1.8–2.4 mm long, the claw 0.2–0.4 mm long, the oblong-elliptic to -obovate, obtuse blade 1.6–2 mm long, 0.7–0.9 mm wide; *androecium* (9) 10-merous, 4.4–6 mm long, the longest filament free for 1.6–2 mm, the pale yellow, gland-tipped anthers ± 0.4 mm long; *pod* obliquely obovoid or triangular-obovate in profile, disregarding the terminal but excentric style-base ± 2 mm long, crested ventrally in the upper half, densely barbate across the top, the valves membranous and glabrous in the lower ½ or ⅔, thinly papery but opaque and often charged with several minute glands distally; *seed* ± 1.3–1.6 mm long. — Collections: 30 (i).

Brushy and grassy hillsides and banks of ravines, sometimes along highways, commonly associated with arid tropical thorn-scrub but ascending into the lower edge of the oak-belt, 20–1550 m (± 70–5170 ft) but mostly below 1000 m, widely dispersed along the Pacific slope of Mexico from southern Sonora to western Jalisco, thence east up the valley of Río Grande to Guadalajara; also in scattered stations in the Balsas Depression and Sierra Madre del Sur in Estado de México, Morelos, and Guerrero; and somewhat isolated on the north slope of the Coast Range in western Chiapas (to be expected in Oaxaca) and on the Atlantic slope in Veracruz. — Flowering in the dry season, mostly from November onward, but sometimes (especially northward) in spring and summer. — *Representative*: SONORA: *Gentry 3613* (ARIZ, F, UC), *4858* (NY, UC). SINALOA: *Gentry 5678* (ARIZ, NY, MEXU), *5696* (ARIZ), *5803* (ARIZ). DURANGO: *Palmer 164* (F, GH, NY, UC); *Gentry 5242* (ARIZ, GH, MEXU, NY). NAYARIT: *Rose et al. 14,204* (GH, NY, US). JALISCO: *Mexia 1831* (F, GH, UC). MÉXICO: *Hinton 3338* (F, MEXU, NY, US), *15,780* (F, NY, UC). MORELOS: *Pringle 10,402* (ARIZ, F, L, UC). PUEBLA: *Fröderström & Hultén 1037* (F, NY). GUERRERO: *Hinton 15,420* (GH, NY, UC, US). VERACRUZ: *Purpus 5741* (F, NY, UC); *M. Sousa 2989* (MEXU). CHIAPAS: *Matuda 1969* (ARIZ, F, MEXU).

Dalea elata (tall) H. & A., Bot. Beechey Voy. 416. 1840. — "Hab. Acapulco." — Holotypus, collected by Lay and Collie in 1840, K! isotypus (fragm.), NY! — *Parosela elata* (H. & A.) Rydb., N. Amer. Fl. **24**: 79. 1920.

Dalea flava (yellow, the flowers so fading) M. & G., Bull. Acad. Brux. **10**[2]: 40. 1843. — "...dans les ravins humides de Zacuapan et de Mirador, à 3000 pieds..." — Holotypus, *Galeotti 3405*, from "Barranca de Zacuapan", Veracruz, collected in January, 1840, BR (herb. Martius.)! — *Parosela flava* (M. & G.) Rydb., N. Amer. Fl. **24**: 79. 1920.

Parosela pauciflora (few-flowered, inappropriate) Rose, Contrib. U. S. Nat. Herb. **10**: 106. 1906. — "Type...collected by C. G. Pringle...near Guadalajara, Jalisco, December 12, 1888 (no. 1825)." — Holotypus not found at US; isotypi, K, M. MEXU, NY, UC, W, Z!

Due partly to great differences in stature between flowering and therefore apparently or truly mature plants derived from different populations, and partly to much variation in pubescence of the foliage and calyx, *D. elata* eludes neatly exact definition. In general aspect it combines something of the habit of *D. carthagenensis* with the spikes of *D. leporina*, at the same time lacking any marked individual character of its own. In fine detail the flower is like that of *D. revoluta* and *D. grayi*, with this difference: the filaments are separated for a shorter space and the inner petals, in consequence, appear to perch further from the point of separation. This small technical character sufficed to refer *D. elata*, in Rydberg's classification, to *Parosela*, remote from its close relatives which were transferred to *Thornbera*.

My inclusive concept of *D. elata* is exactly coextensive with *Parosela* XIV. *Flavae* Rydb., which was composed of a common, more or less densely pubescent *P. flava* and a glabrate *P. elata*. In the typus of *D. elata* the stems are almost hairless, the leaflets are glabrous on both sides and glaucescent beneath, while the calyx-tube and back of the bracts are also nearly glabrous. However a topotype from Acapulco (*Palmer 494*) shows remnants of villosulous vesture on the upper stem and leaf-rachis; in *Haenke 1617* a glabrous calyx-tube and glabrous bracts are found on the same plant with thinly villosulous but bicolored leaflets; and in *Hinton 3338* (NY) bicolored leaflets densely pubescent both sides are combined with the ordinary villous calyx. Since the habit of growth, the flower, and other features are identical, I feel confident that *D. elata* and *D. flava* are best interpreted as pubescence-variants of one species.

More striking than the differences in vesture, so commonplace in *Dalea*, is the variation in stature and, correlated with stature, in number of leaflets, in plants of *D. elata* collected in full flower and fruit. Southward from Sinaloa and Durango the mature plant is obviously perennial, with one to several, erect or assurgent, eventually indurated or truly suffrutescent stems that deserve the epithet *elata* by reachins heights of one to two, more really three meters. In such plants the main cauline leaves, which are deciduous late in season, have seven or more, sometimes up to twelve pairs of leaflets; upward, on branchlets of the panicle or on sterile lateral shoots, the leaves are reduced in size and the leaflets reduced to some four to six pairs. At low elevations in southern Sonora and in Sinaloa the plants often flower as diffuse herbs, sometimes during the first season's growth, appearing annual in consequence. Such plants develop no long cauline leaves; all are about 4–5-foliolate but not otherwise different from leaves in the panicle of the taller forms. Several collections from the Río Mayo valley collected by Gentry were segregated by Standley under an unpublished herbarium name, but I interpret them as representing a juvenile state of *D. elata*. At Alamos H. D. Ripley collected the same thing beginning to flower in February, and he reported that all individuals seen were of the same apparently annual type with weak, diffuse stems. It seems possible that the desert climate at the edge of the Sonoran Desert may have operated to select a rapidly flowering and rapidly maturing ecotype, and this may eventually require taxonomic status. For the present I must mention that typical, tall, obviously perennial *D. elata* was also collected by Gentry in the same region, albeit at greater elevations in the foothills.

I readily endorse Rydberg's reduction of *Parosela pauciflora*. In describing it, Rose seems to have overlooked *D. elata* and *D. flava* entirely. The earliest known collection of *D. elata* was made by Haenke in 1791, very likely near Acapulco or along the *camino real* between Acapulco and Mexico City.

IIIB. Sectio Dalea

Monocarpic herbs (sometimes coarse and tall, not obviously annual when dried), flowering mostly in late summer to winter; *epistemonous petals* all free, or the inner pair overlapping and adherent (but not concealing the anthers); *filaments* only shortly separated, the free tassel ⅓ or less as long as the column (or column and sheath combined). — Spp. 13, all native in Mexico, most frequent in the w. and s., several extending into s.-w. (one into centr.) United States, 3 s. into Central America, and 2 of these old denizens of n. South America or the higher Andes; 1 naturalized in Islas Filipinas.

Dalea subgen. **Dalea** sect. **Dalea**. *Dalea* Luc., sens. str. — Sp. typica: *D. cliffortiana* Willd.

Key to the Series and Species of Sect. *Dalea*

1. Bracts persistent, the interfloral ones falling if at all only with the calyx and ripe pod.
   2. Stems prominently angulate by ribs decurrent from the leaf-spurs; *terminal leaflet* (except sometimes in *D. obreniformis*) solitary, stalked beyond the last pair; *epistemonous petals* perched much above half-way between hypanthium and anthers, at or close up to separation of the short filament-tassel (or if half-way, and below the tassel, the foliage ± pubescent, either the leaf-rachis or leaflets ciliolate); ser. *Dalea* (p. 191).
      3. Leaflets, leaf-rachis, and stems completely glabrous.
         4. Leaflets of main cauline leaves 7 and more; *post-petiolular* glands small but usually prominent; *petals* (or some of them) blue or purple (all white only in rare albino individuals).
            5. Bracts lance-acuminate to ovate-caudate, the body not retuse at apex but ± gradually contracted into the tip or tail; *flowers* bicolored, the banner opening white, the *epistemonous petals* blue or purple.
               6. Leaflets 3–7, mostly 4–6 pairs; *interfloral bracts* pilosulous dorsally and densely ciliate or ciliolate, acuminate to shortly caudate, the tail not surpassing the flower; *calyx* 3–5 mm long, its longest tooth (1.3) 1.5–3.3 mm long; *epistemonous petals* 2–3.4 mm long; *androecium* 4.5–6.7 mm long, 9–10-merous; common weedy annual of *tierra caliente* of w. and s. Mexico and Centr. America, long naturalized in n. Venezuela, coastal Ecuador, and Islas Filipinas. 18. *D. cliffortiana*.
               6. Leaflets 5–12, mostly 6–10 pairs; *bracts* all glabrous dorsally (rarely minutely ciliolate), caudate, the tail much surpassing the flower; *calyx* 1.8–2.5 mm, its longest tooth 0.5–0.8 (1.1) mm long; *epistemonous petals* 0.8–1.4 mm long; *androecium* 3–3.5 mm long, (4) 5–7 (8)-merous; rare in the Transverse Volcanic Belt in Nayarit and Michoacán. 19. *D. dipsacea*.

5. Bracts (disregarding the outermost) cordately retuse at apex, the tail reduced to a mucro usually shorter than the sinus; *flowers* concolorous, the petals all blue. Androecium 2.4–3.6 mm long, 5 (6)-merous; range bicentric: Transverse Volcanic Belt from Morelos to w. Michoacán; Sierra Madre Occidental in s.-w. Chihuahua.
20. *D. obreniformis.*

4. Leaflets 1–5; *post-petiolular glands* subimpressed; *petals* all white (the banner faintly rubescent in age). Bracts all deltate-ovate; *androecium* 3–3.5 mm long, 10-merous; local in w. Michoacán and adjoining Jalisco.
21. *D. plantaginoides.*

3. Leaflets, leaf-rachis, or stems at least thinly pubescent, sometimes inconspicuously so.

7. Ribs of the calyx filiform, the intercostal membranes inconspicuously glandular; *petals* all purple; *leaflets* 1–5 pairs, thinly ciliolate with weak spiral hairs, the stems and foliage otherwise glabrous; obligate annual plants of pine-oak zone in Sierra Madre Occidental, n. into s.-w. United States and s. in Mexico to n. Michoacán; *androecium* 5–7-merous.

8. Leaflets of main cauline leaves 1–2 pairs; *epistemonous petals* 4, perched at or just below separation of the short filament tassel, the inner pair free even in bud; xerophytes, of oak-pine woodland, s.-w. New Mexico to n.-e. Sonora, w. Chihuahua.
22. *D. exigua.*

8. Leaflets of main cauline leaves 3–5 pairs; *epistemonous petals* 2 or 4, perched well below separation of most of the filaments, the inner pair, if present, weakly adherent into anthesis; local in swales or muddy shores, w.-centr. Chihuahua, e. Jalisco, and n. Michoacán.
23. *D. confusa.*

7. Ribs of calyx thickened and prominent, the intercostal membranes narrow, recessed, and charged with very prominent black or orange glands; *petals* white; *leaflets* mostly numerous, in some juvenile forms only 4–7 pairs; pubescence of plant highly variable, but not as the preceding; precociously flowering perennial, finally suffruticose plants of *tierra caliente*, not in the range of the preceding; *androecium* (9) 10-merous: see *D.* (sect. *Thornbera* ser. *Flavae*) *elata* (p. 186).

2. Stems terete or finely striate but not prominently angulate; *terminal leaflets* stalked only in the habitally distinct *D. emarginata*, differing from all kindred in elongate peduncles:

9. Peduncles (0.6) 1–4 dm long, the longest on a plant as long or longer than the leafy axis that bears it, the spike very dense and conelike; *leaflets* mostly 5–8 pairs; *keel-petals* free; *prow* of the pod dilated and bicarinate; coarse annuals, often many-stemmed from the base, of the Gulf Coastal Plain, s.-w. Louisiana to Veracruz; ser. *Emarginatae* (monotypic).
24. *D. emarginata.*

9. Peduncles mostly 1–9, rarely 15 cm long, but always much shorter than the leafy axis; *spikes* moderately dense, not conelike; *leaflets* (1) 2–4 (5) pairs; *keel-petals* overlapping and adherent; *prow* of pod filiform; slender annuals, simple or few-branched from the base, of the mountains of w. and s. Mexico and s.-w. United States; ser. *Polygonoides* (p. 205).

10. Bracts glabrous internally, charged on the back with a few large blister-glands; *calyx-tube* charged in each interval with 1 (2) large orange glands; *petals* all, or all but the banner, glandless; *androecium* 2.2–3.5 mm long, the anthers not protruding beyond the keel at anthesis; n. Sierra Madre Occidental, w.-centr. Durango n. to centr. Arizona, e. to centr. New Mexico and Davis Mts. in trans-Pecos Texas.
26. *D. polygonoides.*

10. Bracts densely silky-pilosulous internally, livid-nigrescent but only minutely glandular on the back; *calyx-tube* charged in each interval with ± 3 minute glands; *petals* all finely gland-sprinkled; *androecium* 3.6–4.7 mm long, the anthers protruding beyond the keel at anthesis; s. and w. Mexico, local (México and Morelos; w.-centr. Durango). 25. *D. thouini.*

1. Bracts between the flowers deciduous before or at least by full anthesis. Terminal leaflets sessile, forming with the last pair an exact trefoil; ser. *Urceolatae* (p. 209).
   11. Leaflets of main cauline leaves mostly 8–19 pairs, if fewer the calyx glabrous externally; *flower* relatively large, the banner mostly 4–7 mm long; *plant* variable in stature but the stems and peduncles not subfiliform; widespread.
      12. Androecium (including column and sheath) 4.2–7 mm long, exserted at most 2 mm beyond the longest calyx-tooth.
         13. Calyx villosulous externally from base upward, its tube not or scarcely tumescent in age; widespread and variable, centr. United States to n.-w. Argentina, especially abundant through *tierras templadas* of Mexico and Centr. America. 27. *D. leporina.*
         13. Calyx glabrous externally except around the orifice and on the teeth, the tube early tumescent, in age ovoid-ellipsoid; relatively rare, along Sierra Madre from Durango n.-ward into centr. Arizona and s.-w. New Mexico, and in the Transverse Volcanic Belt from México to Jalisco. 29. *D. urceolata.*
      12. Androecium (7.5) 8–11 mm long, exserted well over 2 mm beyond the longest calyx-tooth; widespread but scattered, most frequent in Balsas Depression of s. Mexico, thence to Costa Rica; Gulf slope in Veracruz; isolated in e. Sonora, adjoining Chihuahua, and extreme s. Arizona. 28. *D. exserta.*
   11. Leaflets 2–5 (6) pairs [if exactly 1 or 2 pairs and truly filiform, cf. *D.* (subgen. *Parosela*) *filiformis*]; flower very small, the banner 2.4–3 mm long; *plant* filiform; very local in Durango. 30. *D. transiens.*

IIIB (i) Series Dalea

Annual herbs with prominently angulate stems; *terminal leaflet* (except sometimes in *D. obreniformis*) solitary, stalked beyond the last pair; *epistemonous petals* perched (except in *D. confusa*) at or close under separation of the short filament tassel; *androecium* 5–10-merous, the number of functional stamens often variable; spp. 6, all Mexican, 1 extending n. into s.-w. United States, 1 a tropical weed extending to n. Venezuela and Ecuador.

Dalea subgen. **Dalea** sect. **Dalea** ser. **Dalea**. *Dalea* Luc., sens. str. — Sp. typica: **D. cliffortiana** Willd.

18. Dalea cliffortiana Willdenow
(Plate XLII)

Annual herbs, sometimes of long duration, variable in habit and stature, 0.8–7 dm tall, glabrous up to the inflorescence or very thinly and obscurely puberulent distally, the striate-angular, smooth to sparsely punctate or verruculose, stramineous or purplish stems either erect, then either simple and monocephalous or paniculately

few-branching at and above middle (the branches often surpassing the central axis), or branched from the base, the stems then incurved-ascending or rarely prostrate, the foliage green, the leaflets ± bicolored, paler and livid-punctate beneath; *leaf-spurs* up to 1 mm long; *stipules* 0.8–3 (4) cm long, narrowly triangular-subulate to sublinear, usually purplish; *intrapetiolular glands* minute; *post-petiolular glands* small but prominent; *leaves* (1) 1.5–4.5 (5) cm long, shortly petioled, with margined, commonly livid-punctate rachis and (3) 4–6 (7) pairs of narrowly oblong-oblanceolate to linear-oblanceolate or -elliptic, subacute or minutely emarginate, distally gland-crenulate, dorsally carinate but flat or only marginally involute leaflets (2) 3–16 mm long, the terminal one elevated beyond and longer than the last pair; *peduncles* terminal to the main and all lateral axes, subobsolete up to 3 (5) cm long; *spikes* very densely many-flowered, the flowers crowded together in several to many spirally ascending ranks, ovoid to ovoid-oblong or the largest becoming cylindroid in age, without petals (6) 7–12 mm diam, the pilosulous axis becoming (0.8) 1–5.5 cm long; *bracts* persistent, lance- or elliptic-acuminate to obovate and abruptly caudate, 3–6 (7) mm long, the body nearly always livid or blackish and glandular-verrucose dorsally toward the middle, pallidly membranous-margined, the lowest (often lacking a flower) glabrate and ciliolate, the rest ± densely pilosulous, plumose-ciliate, glabrous within; *calyx* (3) 3.8–5 mm long, densely pilose or pilosulous, the tube 1.4–2.3 mm long, recessed behind the banner, the ribs slender, commonly livid, the membranous intervals glandless or charged with 1–2 (3) small yellowish glands, the triangular to lance-acuminate or -aristate teeth of nearly equal length, (1.3) 1.7–3.3 mm long, varying from a little shorter to twice longer than the tube; *petals* normally bicolored, the banner white, faintly rubescent in age, the epistemonous ones most commonly rich, vivid blue, more rarely violet or rose-purple, pink, or exceptionally white, these perched just below separation of the filaments, the keel-blades imbricate in vernation but free; *banner* 3.2–5 mm long, spatulate, the claw 1.6–3.4 mm long, the oval-ovate blade 1.5–2.2 mm long, 1–1.4 mm wide; *wings* ± 2–2.5 mm long, the claw very short, the blade broadly oblong 1.3–1.6 mm wide; *keel-petals* (2.1) 2.4–3.4 mm long, the claw 0.2–0.6 mm, the broadly obovate to suborbicular blade (1.9) 2.1–2.8 mm long, 1.4–1.7 mm wide; *androecium* 9–10-merous, 4.5–6.7 mm long, the longest filaments free for 1.1–1.9 mm, the connective minutely gland-tipped, the nearly round anthers livid-purple or sometimes pallid, 0.2–0.3 mm long; *pod* obliquely obovoid or half-obovoid, 2.1–2.6 mm long, the style-base terminal, the valves in the lower ± ⅔ glabrous and hyaline, thinly papery and densely villosulous distally, the prow a little thickened; *seed* 1.3–1.7 mm long; n = 7_{II} (Spellenberg, 1973); 2n = 14 (Mosquin). — Collections: 182 (xvi).

Dry fields, roadsides, waste places, disturbed soil of riverbeds and stream banks, in arid grassland and drought-deciduous thorn-scrub, ascending in open places into the oak-belt, from near sea-level up to 1600 (1950) m (but mostly below 1000 m), widespread and common almost throughout lowland Mexico s.-ward from the Transverse Volcanic Belt, from Nayarit to Veracruz, Oaxaca, and Chiapas, extending n. along the Pacific coastal plain and adjoining foothills of Sierra Madre as far as Río Mayo in w. Chihuahua (± 28° N) and along the Gulf slope to s.-e. San Luis Potosí (22° N), apparently absent from Tabasco and Yucatán Peninsula; from Mexico abundantly s. through upland and drier regions of Central America to w. Panama; in South America probably adventive but naturalized and locally plentiful especially in the Coastal Cordillera of n. Venezuela (Yaracuy and n. Cohedes to Miranda, with one record from the Orinoco Basin near San Fernando de Apure); coastal Ecuador (near 2° S); naturalized since early XIX century in Islas Filipinas. — Flowering where na-

tive from late summer through fall and winter. — *Representative*: MEXICO. Chihuahua: *Gentry 1871* (ARIZ, F, UC). Sinaloa: *Shreve 7830* (ARIZ, F). San luis potosí: *Purpus 5270* (UC). Durango: *Gentry 5275* (ARIZ, NY). Nayarit: *Mexia 753* (F, GH, MICH, NY, UC, US). Jalisco: *Pringle 2494* (BR, F, GH, M, MICH, NY, SD, W); *Ripley & Barneby 13440* (CAS, GH, NY, MEXU, MICH, US). Michoacán: *Hinton 15152* (GH, NY, RENNER, UC). México: *Hinton 11501* (F, NY, MICH, UC). Morelos: *Ripley & Barneby 14542* (CAS, NY). Veracruz: *Purpus 1900* (F, NY, UC, Z). Colima: *Palmer 933* (MICH, NY, UC, US). Guerrero: *Mexia 8787* (ARIZ, F, NY, UC, US). Oaxaca: *Liebmann 4585* (F). Chiapas: *Breedlove 7510* (NY, US). GUATEMALA. Chimaltenango: *Standley 57951* (F, NY). Chiquimula: *Steyermark 31202* (F). Guatemala: *Standley 59555* (F). Huehuetenango: *Standley 81351* (F). Jalapa: *Heyde & Lux 3744* (M). Jutiapa: *Standley 60556* (F). Quiche: *Standley 6248* (F). Santa Rosa: *Standley 77801* (F). Zacapa: *Steyermark 29696* (F). EL SALVADOR. Santa Ana: *Standley & Padilla 3344* (F). HONDURAS. Choluteca: *Molina 23237* (NY). Comayagua: *Standley 56241* (F). El Paraíso: *Williams & Molina 10684* (F). Lempira: *Standley 12988* (F). Morazán: *Molina 18459* (NY). Ocotepeque: *Standley 27970* (F). Olancho: *Standley 17997* (F). Santa bárbara: *Molina 3779* (F). Valle: *Standley 22802* (NY). PANAMA. Herrera: *Burch et al. 1301* (NY). VENEZUELA. Mérida: *Fendler 311* (BR, OXF, K). Yaracuy: *Curran 295* (NY). Carabobo: *Linden 1518* (F, NY, OXF, W). Aragua: *Chardon 173* (US). Distrito Federal: *Alston 5252* (NY, US). ECUADOR. Guayas: *Svenson 11266* (NY, US). ISLAS FILIPINAS: *Cuming 449* (K, L, M); *Van Steenis 17878* (L).

Dalea cliffortiana (George Clifford, 1685–1760, patron of Linnaeus) Willd., Sp. Pl. **3**: 1336. 1802, based on *Psoralea dalea* (former generic name) L., Sp. Pl. 764. 1753. — "*Habitat* in America." + reference back to *Dalea* L., Hort. Cliff. 363, tab. 22. 1738. — No type-specimen known to survive, the plant in herb. Linn = *Dalea leporina* (Ait.) Bullock, the holotypus therefore the cited plate in *Hortus Cliffortianus*! — *Psoralea annua* Mill., Gard. Dict., Ed. 8 (*Psoralea* no. 6). 1768, nom. illegit., a superfluous substitute for the cited *Ps. dalea* L. *Dalea linnaei* Mchx., Fl. Bor. Amer. **2**: 57. 1803, quoad nom. (the plant described also = *D. leporina*). *Dalea annua* (Mill.) O. Kze., Rev. Gen. 178. 1891. *Dalea annua* β *willdenowii* O. Kze., Rev. Gen. 178. 1891, evidently based primarily on *D. cliffortiana* Willd. *Dalea dalea* (L.) MacMill., Metasp. Minn. Vall. 330. 1892 ("*Dalea*"). *Parosela dalea* (L.) Britt., Mem. Torrey Club **5**: 196. 1893 ("*Dalea*"). *Parosela cliffortiana* (Willd.) Rose, Contrib. U. S. Nat. Herb. **10**: 105. 1906 ("*cliffortiana*"). *Thornbera dalea* (L.) Rydb. N. Amer. Fl. **24**: 120. 1920 ("*Dalea*").

Dalea acutifolia (with sharp-pointed leaflets) S. & M. ex DC., Prod. **2**: 245. 1825. — "...in Mexici montibus Chilapae humidis [i.e. Guerrero]..." — Holotypus, Calques Dess. Fl. Mex. Pl. 228! — Specimens of *D. cliffortiana* distributed by Pavón, probably from the collections of Sessé & Mociño, are extant at BM ("*Dalea polystachya* sp. nov.") and OXF (see next paragraph); also in *Herb. Sessé, No. 2680* (F, MA), as "*Dalea antihydrophobica*"; some may be isotypic, but cannot safely be cited as such. — *Parosela acutifolia* (DC.) Rose, Bot. Gaz. **40**: 144. 1905.

Dalea angustifolia (with narrow leaflets) G. Don, Gen. Hist. Dichl. Pl. **2**: 223. 1832. — "Native of Mexico...(v.s. in herb. Lamb.)." — Holotypus, labelled originally "*Dalea* sp. nov. de Mexico", annotated probably by Don "*angustifolia*", the specimen doubtless acquired by Lambert from Pavón, OXF!

Amorpha glandulosa (gland-sprinkled) Blanco, Fl. Filip. 555. 1837 ("*Glandulosa*"). — "...mui común en Angat, y entre Lipa y Tanduan." — No typus known to survive, but the description, already accepted by Merrill, decisive. — *Dalea glandulosa* (Blanco) Merrill, Philip. Gov. Bur. Lab. Bull. **27**: 37. 1905.

Dalea nigra (black, of the bracts) Mart. & Gal., Bull. Acad. Brux. **10**[1]: 43 (in separate 13). 1843. — "Se trouve dans les savanes de Zacuapan [Veracruz] avec le *Dalea elata* nobis, à 3,000 pieds." — Holotypus, *Galeotti 3263*, BR (herb. Mart.)! isotypi, BR (herb. Gal.), W, and mislabelled "Cordillère (Oaxaca)", P! — *Parosela nigra* (Mart. & Gal.) Rose, Contrib. U. S. Nat. Herb. **10**: 105. 1906.

Dalea virgata (rodlike, of the stiff stems) Micheli, Bull. Herb. Bss. **2**: 442, Tab. 9. 1894. — "Hab. Costa Rica prope S. José et Buenos-Ayres ad vias, leg. Pittier, N. 1462, 3828, 6504." — Not seen at G, perhaps overlooked by inadvertence; isotypus, *Tonduz 1462*, collected Dec 1, 1889 and distributed by Pittier, BR! paratypus, *Pittier 6504*, BR! — *Thornbera robusta* (stout) Rydb., N. Amer. Fl. **24**: 121. 1920 (non *Dalea virgata* Lag., 1816). *Parosela dalea* var. *robusta* (Rydb.) Macbr., Contrib. Gray Herb., New Ser. **65**: 22. 1922. *Dalea robusta* (Rydb.) Cowan, Brittonia **8**: 60. 1954.

Thornbera pumila (dwarf) Rydb., N. Amer. Fl. **24**: 120. 1920. — "Type collected at Culiacan, Sinaloa, October 5, 1904, T. S. Brandegee..." — Holotypus, US! — *Parosela pumila* (Rydb.) Macbr., Contrib. Gray Herb., New Ser. **65**: 23. 1922. *Dalea pumila* (Rydb.) Riley, Kew Bull. **1923**: 337. 1923.

Over the greater part of its range *D. cliffortiana* is the only species of its group and is easily recognized by the combination of a decisively annual root, few (mostly 4–6 pairs), narrow, glabrous leaflets, closely imbricated persistent bracts more or less pallid-margined and externally glandular-warty, and tiny flowers of which only three or four open each day. The epistemonous petals, usually bright blue, more rarely purple or pinkish-lilac, exceptionally white, are extremely fugitive, commonly shed almost as soon as they are carried up on the summit of the androecial column. The little spoon-shaped banner, always white at first but fading pinkish, disjoints at the same time as the inner petals but is held fast by its claw and often persists as a withered tab until the whole calyx falls away in fruit.

Contrary to what might be expected of a species so burdened with synonymy, *D. cliffortiana* is not very variable. There are taller and dwarfer forms, and the spikes vary a good deal in thickness, due to variation in length of the bracts and calyces and in number of flowers arranged in each spiral around the receptacle. Due probably to autogamy, the populations are usually homogeneous internally, with the result that when two occur close together, or intermingle marginally, they may often be sorted into categories, giving the impression of distinct races. In the field these can be striking, but the now extensive herbarium record shows that the various modes of variation are not correlated with each other or with geographic dispersal, making taxonomic division of the species impracticable. At low elevations along the Pacific coast of Mexico the prevalent form of *D. cliffortiana* is characterized by relatively dwarf and slender stature combined with relatively narrow heads of short-acuminate bracts. The extreme in this direction has been segregated as *Thornbera pumila*, but even in Sinaloa, from which it was described, it does not fully replace the long-bracted and thick-headed form that extends south into Central America and has received the undeserved distinction of *Dalea virgata* or *Thornbera robusta*.

The names *D. angustifolia* Don, *D. nigra* Mart. & Gal. and *D. glandulosa* (Blanco) Merr. were all applied to *D. cliffortiana* to distinguish the species not from the genuine plant grown at Hartekamp and described in *Hortus Cliffortianus*, that is the generitypus of *Dalea* gen. cons., but from the species which long usurped that title, properly known today as *D. leporina* (Ait.) Bullock. The confusion between these two widely dispersed and common, weedy daleas can be traced back to the earliest interpretations of the Linnaean canon, partly due to the fact that the plant preserved in Herb. Linnaeanum as *Dalea* is actually *D. leporina*. The identity of the plant described by Linnaeus is securely known through the plate in *Hortus Cliffortianus* and through a specimen preserved by Philip Miller which represents the original introduction from Veracruz. Because these two species

have been confounded in so many herbaria and in so many important floras and are still often misidentified in modern collections the following contrasts may be useful:

1. Leaflets (3) 4–6 (7) pairs; *bracts* between the flowers persisting until the whole spike falls apart in advanced fruit; *epistemonous petals* borne at or scarcely below separation of the filaments. *D. cliffortiana.*
1. Leaflets (of cauline leaves) 8–17 (24) pairs; *bracts* deciduous at or just before anthesis of the flowers; *epistemonous petals* borne ± half-way between hypanthium and separation of the filaments (at least 1.2 mm below that point). *D. leporina.*

19. DALEA DIPSACEA Barneby

(Plate XLIII)

Erect annuals (1) 1.5–5.5 dm tall, glabrous to the inflorescence (the leaf-rachis and top of peduncle sometimes minutely puberulent), the stiff but slender, angular-ribbed, green, remotely micro-glandular stems either simple and monocephalous or branched above the middle and each branch monocephalous, the foliage ± bicolored, green above, paler and gland-dotted beneath; *leaf-spurs* up to 1 mm long; *stipules* setiform, pallid or brownish, 1–2.5 (3) mm long; *post-petiolular glands* small, pallid, scarcely prominent; *intrapetiolular glands* 2, minute; *main cauline leaves* (deciduous upward toward anthesis) 2.5–4 cm long, sessile, with broadly margined, ventrally flattened rachis and (5) 6–10 (12) pairs of oblong-oblanceolate, obtuse but gland-mucronulate, distally gland-crenulate, flat or loosely folded leaflets 4–8 mm long, the terminal one a trifle longer than the last pair, solitary; *peduncles* (0.3) 1.5–7 cm long; *spikes* very densely many-flowered, conelike, oblong becoming cylindric, including the bract-tails 1–1.2 cm diam, the thinly pilosulous axis concealed by flowers, becoming 1–4 cm long; *bracts* persistent, 5–6 mm long, glabrous except for the sometimes minutely ciliolate margins, the obovate body 2–2.5 mm long, embracing the calyx, hyaline in lower half, distally firm, green, and charged with a few small pale blister-glands, abruptly contracted into a firm, linear-acuminate, spreading and then incurved-ascending tail 2.8–3.8 mm long, the whole sharply keeled by a corneous midrib; *calyx* 1.8–2.3 (2.5) mm long, thinly pilosulous externally with fine, loosely ascending hairs up to 0.35–0.5 mm long, the membranous, pallid tube 1.1–1.5 mm long, a little recessed behind the banner, the ribs filiform, almost colorless, the broadly deltate-ovate, terminally cuspidate, green or green-edged teeth 0.5–0.8 (1.1) mm long; *petals* eglandular, bicolored, the banner white, the inner pairs blue-violet, the epistemonous ones inserted at the separation of the filaments, the keel-petals free from the first; *banner* 2.4–2.9 mm long, the claw 1.1–1.5 mm, the erect, ovate, obtuse, loosely folded blade ± 1.4 mm long, 1–1.2 mm wide; *wings* and *keel-petals* similar, the latter a trifle larger, 0.8–1.4 mm long, the subsymmetrically obovate, obtuse, 1–3-nerved blades 0.7–1.1 mm long, 0.4–0.7 mm wide, contracted at base into a claw 0.1–0.3 mm long; *androecium* (4) 5–7 (8)-merous, commonly with only 4–6 fully developed stamens, the whole 3–3.5 mm long, the filaments free and purple for up to 0.7–1.1 mm, the connective minutely gland-tipped, the anthers 0.3–0.35 mm long; *ovary* thinly pilosulous, the pod and seed unknown. — Collections: 2 (ii).

Grassy openings in oak or oak-pine forest, 900–1100 m (± 3000–3700 ft), forming colonies but apparently local, known only from two stations in the w. half of the Transverse Volcanic Belt in Michoacán (near Uruapan) and Nayarit (near Jalisco). — Flowering October to December.

Dalea dipsacea (teasel-like, of the conspicuously bracteate spike) Barneby, sp. nov., *D. cliffortianae* Willd. similis et affinis, sed bracteis longe subspinoso-caudatis dorso glabris flosculos subdimidio minores suffulcrantibus, androecio breviori (3–3.5 nec 5.5–6.7 mm longo) 4–8 (saepissime 5–7)-mero, foliolisque magis numerosis (foliorum caulinorum majorum 5–12, saepe 6–10, nec 3–7, saepe 4–6-jugis) absimilis. — MICHOACÁN. Uruapan: barranca of Río Cupatitzio ± 14 mi below Uruapan, Oct 12, 1965, *Ripley & Barneby 14,113.* — Holotypus, NY; isotypi, CAS, MEXU, MIXH, US. — NAYARIT. Compostela: 11 mi s. of Jalisco, *Ripley & Barneby 14,045.* — Paratypi, CAS, NY.

The relationship of *D. dipsacea* to *D. cliffortiana* is obvious and close. They are similar in habit and it seems likely that *D. dipsacea* has been passed over for its common, weedy relative; it may well have a much more extensive range in Nueva Galicia than is known at present. The immediately distinctive feature of *D. dipsacea* is the spike of spinosely tailed bracts which are incurved at tip and so suggest, on a small scale, the hooked bristles of the Fuller's Teasel. The shorter androecium composed of fewer fertile stamens and the more numerous leaflets are additional differential features. In foliage *D. dipsacea* resembles the marginally sympatric *D. obreniformis*, but this is quickly recognized by its little obcordate bracts tipped with a minute tail recessed into the terminal sinus.

20. DALEA OBRENIFORMIS (Rydberg) Barneby
(Plate XLIII)

Slender annual herbs, commonly (1.5) 2–6, sometimes only (0.7) 1–2 dm tall, the stiff, prominently ribbed and angled stems usually branched below the middle, sometimes also distally, the main axis (rarely simple) erect, the lateral ones divaricate and ascending, either glabrous below the spikes or minutely pilosulous beyond the middle, sparsely micro-tuberculate distally but otherwise smooth, the glabrous foliage bicolored, the leaflets green above, pallid and livid-dotted beneath; *leaf-spurs* 0.4–1 mm long; *stipules* narrowly subulate-caudate or sublinear, becoming stiff and dry, 1.5–5 mm long, often minutely ciliolate; *intrapetiolular glands* minute or setiform; *post-petiolular glands* small, prominent; *leaves* (1)1.5–4.5 cm long, shortly petioled, the rachis narrowly margined, grooved ventrally, not or scarcely punctate, the leaflets (2) 3–9 pairs, oblong-obovate to narrowly oblanceolate, obtuse or emarginate, submembranous, flat or loosely folded, gland-crenulate near apex, 3–13 mm long, the terminal one (nearly always sessile) slightly longer than the last pair; *peduncles* (beyond the first) all terminal to branchlets, 1–9 (11) cm long; *spikes* densely many-flowered, conelike when young, the shorter ones ovoid becoming oblong, the longer ones becoming cylindroid, without petals 5–7 mm diam, the pilosulous axis (0.5) 1–4 cm long; *bracts* persistent, embracing the calyces, subdimorphic, the lowest ones broadly obovate-truncate and abruptly caudate (1.7) 2.5–3.5 mm long, the tail half as long to nearly as long as the dorsally glabrous or subglabrous body, the rest truncately flabellate, obcordate, or inversely reniform, keeled dorsally, 1.5–3 mm long, the tail reduced to a mucroniform appendage in the apical notch, these often thinly pilosulous dorsally and ciliolate, all along the keel and above the middle livid and charged with orange or pale yellow blister-glands, the margins broadly hyaline; *calyx* thinly pilosulous externally over the whole surface or only along the back, ciliate at mouth, 2.1–3.1 mm long, the tube at first conic-campanulate, later turgid and ovoid, 1.6–2.2 mm long, deeply recessed behind the banner, the subfiliform ribs livid

(at least beyond the middle), the hyaline intervals either eglandular or charged with a row of 1-3 minute glands, the triangular or ovate-triangular, mucronate, minutely gland-spurred, nigrescent teeth subequal or slightly unequal in length, the dorsal one either longest or shortest, 0.5-1.2 mm long; *petals* all vivid blue, eglandular, the wings and keel perched just below separation of the filaments, the keel-petals sometimes a trifle smaller than the wings; *banner* 2.5-3.7 mm long, the claw 1.2-2 mm, the triangular-ovate blade 1.2-2 mm long, 1.2-1.5 mm wide; *wing* and keel-petals 1.1-1.8 mm long, the wings obovate-oblong, the keel-blades broadly obovate, ± oblique, the claw minute; *androecium* (2.4) 2.7-3.6 mm long, 5 (6)-merous, the filaments free for (0.5) 1.6-1 mm, the connective gland-tipped, the exposed but not exserted anthers blue, ± 0.3 mm long; *pod* obovoid, 2-2.6 mm long, the style-base latero-terminal, the valves hyaline in lower ⅔, thinly papery distally, livid along the dorsal crest and filiform prow, finely pilosulous distally but eglandular; *seed* (1.1) 1.3-1.7 mm long; 2n = 28 (Mosquin). — Collections: 20 (x).

Colonial in open pine or pine-oak woodland, descending on malpais into the scrub belt, 1680-2460 m (± 5600-8200 ft), apparently of bicentric dispersal: locally common and rather frequent in the Transverse Volcanic Belt, from Sierra de Tepoztlán, Morelos w. to the latitudes of Volcán Tancítaro in Michoacán; and on or near the crest of Sierra Madre Occidental about the headwaters of Ríos Mayo, Fuerte and Petatlán (at 1800-2160 m) in s.-w. Chihuahua and adjoining Sinaloa (Sa. Surutato); to be sought in Jalisco, Nayarit, and Durango. — Flowering July to December, mostly from September onward in its southern range. — *Representative*: CHIHUAHUA: *Gentry 1951* (ARIZ, F, K, MEXU), *2704* (ARIZ, F, K, MEXU, US). MICHOACÁN: *Ripley & Barneby 13,429* (CAS, MEXU, NY, US), *14,835* (CAS, DAO, NY, US), *13,406* (CAS, K, MEXU, MICH, NY, US); *Hinton 15,561* (G, K, NICH, NY, RENNER, UC, US, W). MÉXICO: *Hinton 8352* (ARIZ, F, K, MEXU, NY); *Ripley & Barneby 13,766* (CAS, MEXU, NY, US). MORELOS: *Ripley & Barneby 14,535* (DAO, MEXU, NY, US), *14,546* (CAS, MEXU, MICH, NY, US).

Dalea obreniformis (Rydb.) Barneby, comb. nov., based on *Petalostemum obreniformis* (inversely kidney-shaped, of the bracts) Rydb., N. Amer. Fl. **24**: 130. 1920. "Type collected at the base of Mt. Mohinora, Chihuahua, 8 miles from Guadelupe y Calvo, August, 1898, *E. W. Nelson...*" — Holotypus (*Nelson 4835*), US! isotypi, K, NY!

This is an inconspicuous, rather weedy little plant, but a most interesting one. It is the only annual *Dalea* known to be tetraploid, and in several aspects of its gross morphology is highly specialized. Notable features are the dense but narrow spikes of tiny, vivid blue flowers, the cordate or inversely reniform bracts of a livid or blackish color folded around the calyces, and an androecium reduced to five or less often six members. Although it was originally described as a *Petalostemum*, because of the few stamens, *D. obreniformis* is much more closely related to *D. cliffortiana*, but easily distinguished from that and all related species by the retuse bracts and concolorous petals of vivid blue. The foliage most nearly resembles that of *D. dipsacea*, but the terminal leaflet is in that species always raised beyond the last pair, in *D. obreniformis* almost always sessile.

The distribution of *D. obreniformis* as known at present is notably discontinuous, a formidable gap separating the populations in Sierra Tarahumare near latitude 26° N and those in the mountains of south-central Mexico at about lat. 19° N. Intermediate stations are to be expected, but even if none are found there seems to be no morphological evidence of distinct races having developed in the two areas. In central Mexico the plants are often browsed, and Gentry reports them "eaten by cattle" on the upper Río Mayo.

21. DALEA PLANTAGINOIDES Barneby
(Plate XLIV)

Erect annuals, glabrous to the inflorescence, 1.5–4.5 dm tall, simple and monocephalous when small, more commonly branching either below or above the middle, the stems and narrowly ascending, monocephalous branches stiff, sharply angled, sparsely punctate but otherwise smooth, the sparse foliage green, the leaflets smooth above, gland-dotted beneath; *leaf-spurs* 0.4–1 mm long, their margins decurrent into the ribs of the stem; *stipules* narrowly subulate, stiff, 0.5–1.8 mm long; *intrapetiolular glands* minute, impressed; *post-petiolular glands* small, barely prominent; *main cauline leaves* (1) 1.5–3.4 cm long, petioled, with broadly thick-margined, punctate rachis, the lowest and uppermost 3-, rarely 1-foliolate, the majority 5-foliolate, the leaflets linear or linear-elliptic, acute, gland-mucronulate, (5) 8–23 mm long, up to 1 mm wide, thick-textured, the margins involute, the dorsal keel prominent when dry; *peduncles* terminal to all the branches, usually less than 10, sometimes only 1 per plant, 2.5–7 cm long; *spikes* dense, ovoid-oblong to cylindric, 8–25 mm long, without petals 5–6 mm diam; *bracts* persistent, broadly ovate to deltate- or rhombic-ovate, very shortly acuminate, 2.5–3.5 mm long, 1.8–3 mm wide, carinate below the middle, broadly scarious-margined, the middle green or purplish, verrucose with prominent reddish glands, the outermost glabrous dorsally, the upper ones villosulous at base, all ciliolate, the tips ± squarrose; *calyx* 2.1–2.5 mm long, glabrous up to the thinly pilosulous and ciliolate teeth, the ovoid, membranous tube ± 1.3– 1.5 mm long, the ribs slender, scarcely prominent, the intervals glandless, the orifice oblique, the ventral sinus recessed behind the banner, the ovate-triangular, acute teeth of nearly equal length, 0.6–1.2 mm long; *petals* opening white, the banner rubescent in age, the caducous inner ones perched just below separation of the filaments; *banner* 2.7–3 mm long, spatulate, the claw and round, scarcely emarginate, flat blade of nearly equal length; *wing* and *keel petals* not strongly differentiated in form, the claws obscure or very short, the blades obovate to elliptic-oblong, obtuse, ± 1.7–2 mm long; *androecium* 10-merous, becoming 3.3–4.3 mm long, the longest filaments free for ± 1.5–1.8 mm, the connective gland-tipped, the anthers 0.3 mm long; *pod* (not seen ripe) ± 2 mm long, obovoid-ellipsoid, keeled both dorsally and ventrally beyond the middle, the style-base terminal but excentric, the valves papery, thinly pilosulous distally, glandless. — Collections: 3 (o).

Pine or pine-oak forest, 1600–2000 m (± 5300–6700 ft), apparently rare and local, but inconspicuous and perhaps overlooked, known only from the w. edge of Balsas Depression on the headwaters of Río Tepalcatepec, about the flanks of Volcán Tancítaro in w. Michoacán and on Sierra de los Corales in s.-e. Jalisco. — Flowering October to December. — *Material*: MICHOACÁN: Tancítaro (type). JALISCO. Tecalitlán: Los Corales, *Rzedowski 17,418* (ENCB, MICH); 15 km w. of Pihuamo, *Feddema 2212* (MICH).

Dalea plantaginoides (plantain-like, of the small, conelike spikes) Barneby, sp. nov., *D. cliffortianae* Willd. manifeste affinis sed foliolis foliorum caulinorum 1–2 (nec 3–7)-jugis, pube bractearum calycisque brevius dentati breviori ac sparsiori, petalisque interioribus albis nec purpureo-coeruleis statim recognita. A *D. exigua* Barneby, allopatrica sed foliolis paucijugis habituque simili, foliolis toto glabris, calycis inferne glabrati dentibus abbreviatis, petalis albis nec purpureis, necnon androecio 10- nec subpentamero longius distat. — MICHOACÁN: hillside in pine forest, 2000 m, Tancítaro, distr. Uruapan, Nov 11, 1940, *G. B. Hinton 15,665*. — Holotypus, NY; isotypi, K, RENNER, UC, US.

This strongly characterized and highly modified annual dalea is related to *D. cliffortiana* and to *D. exigua*. The former is found in the same latitudes but generally below the pine belt; it differs in having at least three, mostly four to six pairs of leaflets in all but an occasional depauperate leaf, in the densely pilose, longer-toothed calyx, and in the bright blue or purplish-blue inner petals. Features common to *D. cliffortiana* and *D. plantaginoides* are glabrous foliage and an androecium of at least nine members. The only related species with 3–5-foliolate cauline leaves are *D. exigua* and *D. confusa*, both of which have leaflets thinly ciliate with long, weak, spiral hairs, purple inner petals, and an androecium variably reduced to 4–7 members. The species most nearly resembling *D. plantaginoides* in habit is *D. exigua*, native to similar environment in the pine forests of the northern Sierra Madre Occidental, over 800 km northward from Tancítaro. The annual dalea common in the Michoacán pinelands is *D. obreniformis*, differing in its many, broader, thin-textured leaflets and bright blue petals.

22. DALEA EXIGUA Barneby
(Plate XLIV)

Slender, erect annual herbs, 1–4 (4.5) dm tall, strict and monocephalous, or few-branched with strictly ascending to divaricate-incurved, monocephalous branches from below or near the middle, or exceptionally 3–4-stemmed from near the base, the stiff stems purplish at base, green and angled upward, smooth, not or very sparsely gland-punctate, the foliage appearing glabrous but the leaflets charged above, along or near the margins, with a few fine, weak, scattered hairs; *leaf-spurs* up to 1 mm long; *stipules* subulate, subherbaceous, 1.5–3 (4) mm long; *intra-petiolular glands* obsolete; *post-petiolular glands* very small and pallid, or obscure; *leaves* 1.5–5.5 cm long, petioled, the rachis narrowly margined, punctate or not, the leaflets of the main cauline leaves 3 or 5, of the upper leaves often only 1, all linear-oblanceolate to -elliptic or narrowly oblong, obtuse to acuminate but always mucronate, (0.5) 1–3.7 (4) cm long, the terminal one longest, the margins ± thickened and elevated, the upper face bright green, the lower paler, punctate; *peduncles* erect, (2.5) 4–16 cm long; *spikes* dense (but hardly conelike), shortly ovoid to oblong becoming narrowly ovoid to cylindroid, without petals 5–8 mm diam, the pilosulous axis becoming (0.8) 1.3–4.5 (6) cm long; *bracts* persistent (falling only with the fruiting calyx), subdimorphic, the lowest 2.5–3.3 mm long, broadly deltate-ovate or rhombic, shortly apiculate, glabrous or nearly so dorsally but ciliolate at base, the interfloral ones narrower, shortly acuminate, membranous-margined at base, pilosulous dorsally and more densely ciliolate, all gland-verrucose dorsally; *calyx* 3.8–4.3 mm long, silky-pilose with refuscent hairs, the tube 1.9–2.2 mm long, the ribs filiform, brown, the membranous-hyaline intervals eglandular, the triangular-cuspidate to lance-aristate teeth 1.2–2.3 mm long; *petals* pink-purplse, concolorous, fugacious, the inner ones perched just below separation of the filaments; *banner* 3.4–4.3 mm long, the oval-ovate blade 1.3–1.6 mm long, 1–1.2 mm wide; *wings* 1.7–2.3 mm long, the claws 0.3–0.4 mm, the oblong-oblanceolate to obovate, truncate-emarginate blades 1.7–2.3 mm long, 0.9–1.1 mm wide, scarcely auriculate basally; *keel-petals* 2–2.5 mm long, the claw ± 0.5 mm, the subsymmetrically oblong-oblanceolate blade 1.7–2 mm long, 1.1 mm wide; *androecium* 4–7-merous, 3.2–4 mm long, with only 3–6 fertile stamens, the longer filaments free for ± 1 mm; *pod* obovate in profile, ± 2.5 mm long, the style-base lateral just below the apex, the slender prow livid-margined, the valves hyaline in lower ⅔, thinly papery and pilosulous distally. — Collections: 19 (ii).

Open grassy slopes and flats in pine or pine-oak woodland, 1500–2160 m (5000–7200 ft), forming colonies but local, along and near the crest of northern Sierra Madre Occidental in w. Chihuahua (mpos. Hidalgo del Parral, Cuauhtémoc, Madera) and n.-e. Sonora (mpos. Babispe, Santa Cruz) n. to the sources of the Gila River in s.-e. Arizona (Santa Cruz, Cochise, Greenlee cos.) and s.-w. New Mexico (Grant Co.). — Flowering August to November. — *Representative*: UNITED STATES. NEW MEXICO: *Rusby 86* (NY). ARIZONA: *Gould & Haskell 4100* (UC); *Ripley & Barneby 5154* (CAS, NY). MEXICO. SONORA: *Thurber 1027* (NY); *S. S. White 2725* (ARIZ). CHIHUAHUA: *Pringle 1212* (F, MEXU, NY), *1585* (BR, UC, W); *LeSueur 706* (ARIZ, F); *Ripley & Barneby 13,881* (CAS, MEXU, NY, US); *Townsend & Barber 278* (NY, US).

Dalea exigua (frail) Barneby, based on *Petalostemon exilis* (weakly) Gray, Pl. Wright. **2**: 41. 1853. — "Hill-sides, near Santa Cruz, Sonora, Sept.; also near the copper mines, New Mexico, Oct. (995)." — Lectotypus, *Wright 995*, GH! isotypi, K, NY, UC, US! paratypus, *Thurber 945* from Sta. Cruz, GH! — *Kuhniastera exilis* (Gray) O. Kze., Rev. Gen. 192. 1891. Non *Dalea exilis* DC., 1825.

This is an inconspicuous, rather weedy dalea, its sparse foliage and narrow heads of minute, vivid pink-purple but fugacious flowers often well camouflaged by the tangle of late summer annuals and grasses among which it delights to grow. Its open forest habitat in northern Sierra Madre is shared by the habitally similar *D. filiformis*, distinguished by its leaves of exactly three, threadlike, truly hairless leaflets and by looser and shorter spikes of fewer flowers. The rare *D. confusa* occurs within the range of *D. exigua* in Chihuahua, at the same elevation but confined to swales and boggy meadows, the only dalea known to require a moist habitat. This resembles *D. exigua* in habit and foliage, especially in its weakly ciliate leaflets, but these are about four, not two pairs in the larger stem leaves and the structure of the flower (mentioned further under the next entry) is quite different. In number and shape of leaflets *D. exigua* most closely resembles the southern Mexican *D. plantaginoides*, but this has quite glabrous foliage and denser, hard and conelike spikes of white flowers.

23. DALEA CONFUSA (Rydberg) Barneby
(Plate XLV)

Erect, slender, annual herbs, 1–4 dm tall, the angular-ribbed stems simple and monocephalous or, more commonly, few-branched from near the base or from near the middle, the branches mostly simple and 1 (rarely 2)-cephalous, not or sparsely punctate distally, appearing glabrous beneath the spikes but the leaflets charged along the margins with a few weakly spreading, spiral hairs, the foliage green, the leaflets somewhat leathery in texture, a little paler and punctate beneath; *leaf-spurs* 0.5–1.4 mm long; *stipules* triangular-acuminate to subulate, firm, brownish, (1) 1.5–3.5 mm long; *intrapetiolular glands* minute, spicular or conic; *post-petiolular glands* prominent; *leaves* subsessile, 0.8–3 cm long, with rather broadly margined, glandless rachis and 2–4 pairs of oblanceolate to oblong-elliptic, short-acuminate, subacute, or obtuse and mucronate, flat or marginally involute leaflets (3) 4–15 mm long, the terminal one longest, stalked beyond the last pair; *peduncles* 0.2–7 cm long; *spikes* very dense, conelike, ovoid to subglobose becoming ovoid-oblong, without petals 6–8 mm diam, the pilosulous axis 5–20 mm long; *bracts* persistent (shed only with the ripe fruit and calyx), subhomomorphic or the lowest sometimes longer than the rest, the interfloral ones 2.2–4.5 mm long, the body cuneate-flabellate, -obcordate, or oblanceo-

late, subtruncately contracted into a tail ± 0.8–2.5 mm long, membranous-margined proximally, glabrous and commonly charged with a few glands dorsally, ciliolate beyond the middle, the tip of the body and the tail ± nigrescent; *calyx* 3-4 mm long, pilosulous with silvery (rufescent), ascending hairs, the tube 1.7–2.1 mm long, a little recessed behind the banner, the ribs subfiliform, brown or nigrescent distally, the hyaline intervals plane and glandless, the ovate-triangular, mucronate or short-acuminate, nigrescent or livid, gland-spurred teeth (1.2) 1.4–2 mm long, the dorsal one sometimes longest, sometimes all nearly equal; *petals* 3 or 5, the banner and epistemonous pair or pairs concolorous, rose-purple, the latter perched at about the level of the calyx-sinuses, well below separation of most of the stamens, all eglandular; *banner* 2.7–3.7 mm long, the ovate-deltate, obtuse- or acute-angled, plane blade 1.4–2 mm long, 1.4–1.5 mm wide; *wings* (if present) and keel-petals not strongly differentiated in size or shape, 1.6–3.1 mm long, the oblanceolate blades 1.3–2.4 mm long, 0.6–1 mm wide, contracted at the scarcely oblique or auriculate base into a claw 0.3–0.8 mm long; *androecium* (4) 5, 6, or 7-merous, 3.3–4.3 mm long, 3 or 4 of the longer filaments usually free for only 0.5–0.8 mm and one (lateral to the androecial sheath) free almost to insertion of the epistemonous petals, the intervening filaments (if present) shorter, the connective gland-tipped, the anthers (of larger stamens) pale, ± 0.3 mm long; *pod* 2.5–3 mm long, described under the varieties.

This seldom collected, weedy but nevertheless exceptionally interesting annual *Dalea* is known from three widely separated localities in west-central Mexico. It was first met with by Pringle in 1887 on the headwaters of Río Papigochic west of Ciudad Chihuahua (near lat. 28° 30′ N), subsequently by Brother Arsène near Morelia de Michoacán (lat. 19° 40′ N), and recently (1963, 1965) by Ripley & Barneby on the south edge of the Meseta Central, between Lagos de Moreno and León, near the Jalisco-Guanajuato boundary (lat. 21° 20′). At the last-named locality the plants grow in mud around the margins of ponds on the volcanic plateau, where they form dense colonies of stiffly upright stems, mixed and competing with a variety of small rushes, cyperaceae, and annual lobelias. The shallow root-system of each individual when pulled from the ground brings with it a pellet or ball of wet clay difficult to wash off, and as similar dried mud is seen on some specimens of the other collections mentioned, it seems likely that the habitat at Lagos is not accidental but typical for the species. No other *Dalea* tolerates water-logged soils.

The close relationship of *D. confusa*, as perceived by Rydberg, is to *D. exigua*. They are essentially similar in habit, have the same type of fine, weak, spiral hairs around the margins of the leaflets, and an equally degenerate androecium that varies between individual flowers from four to seven members, of which five are commonly more vigorous and bear larger anthers. The androecia differ, however, in one respect. In *D. exigua* the filaments, of whatever number, are all equally separated down almost to the insertion of the high-perching keel and form a short tassel typical of ser. *Dalea*. In *D. confusa* the petals are elevated much less far from the hypanthium rim, one lateral filament is separated down almost to the point of petal-insertion, while the rest are united high up beyond the petal-sockets. More easily observed differential characters of *D. confusa* are the denser, cone-like spikes and the shape of the interfloral bracts, the body of which varies from oblanceolate to truncately flabellate as opposed to deltate-ovate or somewhat rhombic in *D. exigua*. As already noted *D. exigua* is an obligate xerophyte which could not be expected to flourish in standing water, as *D. confusa* does at Lagos.

The five collections here referred to *D. confusa* are very similar in habit and vegetative characters but differ in fine detail of the perianth and the pod. The two gatherings from Chihuahua, made by Pringle probably at the same spot on the "pine plains" near Guerrero in 1887 and 1888, have five-petalled flowers; the blades of the keel are imbricated in verna-

tion and adhere lightly by their faces. No really ripe pods were obtained, but the fully formed one is obliquely obovate in profile with a terminal style and a dilated, at least incipiently bicarinate prow. The plants from Jalisco and Michoacán are alike in having in many flowers only one pair of epistemonous petals, apparently representing the keel, the blades of which are free from the first. The dorsal suture of the ripe pod is so strongly developed in relation to the short ventral one that it becomes arched through much more than half a circle, displacing the style-base to a lateral position; and the suture itself, although a trifle thickened and prominent, is simple and not transversely dilated. When first discovered, the southern plant was interpreted as specifically distinct, and the two collections from Lagos were distributed under the name "*Dalea hexandra*" (nom. nud.). Pending the discovery of new stations and comparison of ample material at the same stages of growth I think it prudent to emphasize the likenesses rather than the differences and propose to treat the two types as geographic varieties.

Key to the Varieties of *Dalea confusa*

Inner petals 4, the keel-parts overlapping and weakly adherent; *pod* ± as long as the calyx-tube, its style-base terminal, its leading edge (or prow) flattened and bicarinate; w.-centr. Chihuahua, in the pine belt. 23a. var. *confusa.*

Inner petals 2, rarely 4, the keel-blades when present free from vernation onward; *pod* exserted, ± as long as the calyx-teeth, the dorsal suture convexly arched beyond the lateral style-base, the prow slenderly 1-carinate; e. Jalisco and adjoining Michoacán, in the grass belt. 23b. var. *hexandra.*

23a. Dalea confusa (Rydberg) Barneby var. confusa
(Plate XLV)

Characters as given in the key. — Collections: 2 (o).

Parkland in the pine belt, ± 2000 m, the habitat not recorded but to be sought in swales or low-lying meadows, known only from the headwaters of Río Papigochic, high on the west slope of Sierra Madre in w.-centr. Chihuahua. — Flowering in September and October. — *Material*: Chihuahua. Ciudad Guerrero: base of Sierra Madre, *Pringle 1215* (type-collection), *1584* (BR, M, UC, W).

Dalea confusa (Rydb.) Barneby, comb. nov., based on *Petalostemon confusus* (confounded with *Dalea polygonoides*) Rydb., N. Amer. Fl. **24**: 129. 1920. — "Type collected on pine plains, base of Sierra Madre, September 20, 1887, *Pringle 1215*..." — Holotypus, US, isotypi, F, K, MEXU, NY (2 sheets), UC!

According to Pringle's diary (Davis, 1936, pp. 42, 44, 54) his serial number *1215* was collected partly on September 20 and partly on October 4, 1887, on the pine plains near his encampment, situated "on a bench 2–3 miles south" of Ciudad Guerrero. The second collection, *Pringle 1584*, is dated September 26, 1888, when the collector was in camp "on the mesa south of Rosario," a hamlet and halt on the railway about 10–11 km east of Ciudad Guerrero. Mention is made in Pringle's entry for September 26 of that year of a trip to "the plains and to their ponds," a likely habitat for the *Dalea*. The two stations are in any case only a few miles apart and it is hoped that more material, with ripe fruits, will soon be forthcoming from this original area.

23b. DALEA CONFUSA var. HEXANDRA Barneby
(Plate XLV)

Characters as given in the key. — Collections: 3 (ii).

Colonial in wet, sticky clay soils around ponds and along roadside ditches, ± 1940–2040 m (6500–6800 ft), local, known only from the type-station in e. Jalisco and from near Morelia, Michoacán, to be sought in low, swampy places throughout the Bajio in Guanajuato and adjoining states. — Flowering September to November. — *Material*: JALISCO: *Ripley & Barneby 14,133*, exact topotypes (CAS, DAO, MEXU, MICH, NY, US). MICHOACÁN. Morelia: La Huerta near Morelia, *Arsène 9018* (US).

Dalea confusa (Rydb.) Barneby var. **hexandra** Barneby, var. nov., a var. *confusa* floribus saepe alis destitutis 3-petalis, carinae petalis ab initio inter se liberis, leguminisque sutura dorsali subtili haud dilatato ultra stylum convexe curvato absimilis. — JALISCO: Lagos de Moreno: moist soil along roadside ditch and around shallow ponds, 6800 ft., 7 mi s.-e. of Lagos, Oct 27, 1963, *Ripley & Barneby 13,335*. — Holotypus, NY; isotypi, CAS, GH, K, MEXU, MICH, NY, US.

IIIB (ii). Series EMARGINATAE Barneby

Monocarpic, but coarser and of longer duration (actual or potential) than ser. *Dalea*; leaves (glabrous) confined to the lower half or third of the plant, the spikes elevated on long naked peduncles; *leaflets* mostly 4–8 pairs, ± oblong and emarginate; *pod* obliquely half-obovate in profile, the ventral suture concave, the prow bicarinate. — Monotypic; Gulf Coast and Coastal Plain of s. Texas, adjoining Louisiana, and Mexico.

Dalea subgen. **Dalea** sect. **Dalea** ser. **Emarginate** Barneby, ser. nov., habitu sect. *Kuhnisteram*, filamentis liberis abbreviatis *Daleas* genuinas revocans, ideo inter sectiones quasi intermedia, a serie *Daleis* spicis longissime pedunculatis et legumine retrocurvo abstans. — Sp. unica: *D. emarginata* (T. & G.) Shinners.

24. DALEA EMARGINATA (Torrey & Gray) Shinners
(Plate XLVI)

Monocarpic herbs, sometimes of long duration (over-wintering), glabrous to the spikes, branched from the crown of the orange root, the stems 3–several (up to 100 rarely!) incurved-ascending, simple except for axillary leafy spurs, monocephalous, pallid-glaucescent near base or throughout, (1.5) 2–6 dm tall, finely striate-angular and sparsely microtuberculate distally, leafy in the lowest ⅓–⅔, the peduncles exserted far beyond the leaves, the foliage bicolored, the leaflets dark-green (when dry often verdigris) above, paler, glaucescent and dotted beneath; *leaf-spurs* 0.6–1.6 mm long; *stipules* 1–2.5 mm long, subulate or subulate-attenuate, subglandular, becoming brown and fragile, sometimes minutely ciliolate; *intrapetiolular glands* small, impressed; *post-petiolular glands* small but prominent, hemispherical; *main cauline leaves* (readily deciduous) shortly petioled, (1) 1.5–3.5 cm long, with narrowly thick-

margined, ± tuberculate rachis and (4) 5–8 pairs of oblong-oblanceolate or -obovate, deeply emarginate, flat, thick-textured leaflets 4–9 mm long, the leaves of axillary spurs, when present, often fewer and smaller; *peduncles* (0.6) 1–3.5 (4) dm long, appearing as a continuation of the stems, and as long to twice as long as the leafy part; *spikes* very dense, conelike, at first globose to plumply ovoid, becoming ovoid to shortly cylindroid, obtuse or truncate at apex, without petals 8.5–10.5 (11) mm diam, the pilosulous, pitted axis becoming 1–4 (4.5) cm long; *bracts* persistent (falling only with the ripe fruit), strongly dimorphic, the lower ones closely imbricated, without subtended flowers, the body broadly obovate-flabellate, 1.2–2.5 mm long, 1.8–3.2 mm wide, glabrous or puberulent dorsally, commonly ciliolate, abruptly contracted into a subulate tail half to twice as long, the inner ones spatulate, 3.3–5.2 mm long, the lower half membranous, folded, glabrous or nearly so, expanded distally into a herbaceous or livid, flat or shallowly concave, abruptly short-acuminate blade pilosulous dorsally except for the glabrate tip, all glabrous within, ± micro-verruculose dorsally; *calyx* 3–4.2 mm long, densely pilosulous, especially at base and on both faces of the teeth, with straight, ascending hairs up to 0.8–1.4 mm long, the narrowly campanulate, slightly incurved tube 1.8–2.2 mm long, a trifle recessed behind the banner, the ribs thick but hardly prominent, castaneous or livid, the narrow, membranous intervals charged with 1 row of 4–7 small, pale yellow or almost colorless glands, the narrowly ovate teeth connivent toward the dorsal (adaxial) side, subhomomorphous, 1.1–2 mm long; *petals* magenta-purple, concolorous, eglandular, the episternonous ones perched at (or the abaxial pair slightly below) separation of the filaments, caducous on expansion; *banner* 3.8–4.4 mm long, the filiform claw 2.2–2.8 mm, the quadrately ovate to oblong-ovate, erect blade subcordate at base, emarginate and a trifle hooded at apex; *wing-* and *keel-petals* similar, the latter a trifle larger, 1.7–2.4 mm long, the claw 0.1–1.3 mm, the blades obliquely ovate or oblong-ovate, obscurely auriculate at base, 1–2 (3)-nerved, obtuse or truncate-emarginate at apex; *androecium* usually 5-androus (sometimes a few traces of alternate filaments), 3.8–4.6 mm long, the filaments free for 0.9–1.2 mm, the connective gland-tipped, the yellow anthers ± 0.5 mm long; *pod* obliquely obovoid or half-obovoid, 2.4–2.8 mm long, the persistent, latero-terminal style-base 1.3–2 mm long, the prow bicarinate, the valves membranous at base, thinly papery upward, in the upper ½–⅓ pilosulous and gland-sprinkled; *seed* 1.6–1.9 mm long; 2n = 14. — Collections: 37 (i).

Dunes, sandy fields, sea-beaches, and in light stony alluvial soils of riverine floodplains, near sea-level up to 170 (300) m, locally plentiful on the Gulf Coastal Plain of s. Texas, extending e. just into s.-w. Louisiana, inland in Texas up the Colorado River to Llano County and along the Rio Grande to Dimmit County, thence s. around the Gulf Coast to Veracruz. — Flowering September to January, March to May. — *Representative*: UNITED STATES. LOUISIANA: *D. S. & H. B. Correll 9613* (NY). TEXAS: *Cory 51,222* (NY, UC); *Heller 1799* (NY, UC); *Mosquin 5532* (NY); *Tracy 9084* (NY, WIS). MEXICO. TAMAULIPAS: *Berlandier 3134* (NY, TEX); *LeSueur 216* (ARIZ, TEX). VERACRUZ: *Schiede & Deppe 282* (OXF, W); *Hildebrand 107* (TEX).

Dalea emarginata (T. & G.) Shinners, Field & Lab. **17**: 84. 1949, based on *Petalostemon emarginatum* T. & G., Fl. N. Amer. **1**: 311. 1838. — "Texas, Drummond!" — Holotypus, from Drummond's Collection I, NY! isotypi, "Rio Brazos", with unpublished epithet of Hooker, K, L, and dated "1833", NY (herb. Meissn.)! — *Kuhnistera emarginata* (T. & G.) O. Kze., Rev. Gen. 192. 1891.

This species is rather isolated taxonomically but of great theoretical interest. It was first described as a *Petalostemum* and passed as such until rejected by Wemple; but transferred to *Dalea* it is still without close relatives. The annual root and short tassel of filaments, commonly five but these sometimes alternating with a few barren vestiges of more,

are in agreement with sect. *Dalea*, but the obliquely obovoid pod with shallowly concave ventral suture suggests sect. *Kuhnistera*. The bicarinate prow of the pod recalls that of *D. confusa* var. *hexandra*, but the verdigris discoloration of the dried foliage (not shown in all specimens) is shared by no member of sect. *Dalea* but by several habitally similar kuhnisteras. This peculiar discoloration is found, curiously enough, combined with a doubly prowed pod, in some populations of *D. nana*, a species differing, as it seems fundamentally, in its yellow flower of the parosela type, with united keel-petals enclosing a decandrous androecium. The coincidence is troubling and unexplained. The range of *D. emarginata* includes that of *D. obovata*, which is very similar in flower structure even though immediately recognized by its ample pilose foliage, whitish petals, and less oblique, simply prowed pod which agrees better with sect. *Dalea* than sect. *Kuhnistera*. Following Wemple, I have reluctantly retained *D. obovata* in sect. *Kuhnistera* (= *Petalostemon* sensu Wemple), thereby separating it further than is ideally desirable from *D. emarginata*. Whatever the nature of their kinship, I think it manifestly absurd to refer them to different genera. Occasional specimens of *D. emarginata* have been misidentified as *D. purpurea*, a perennial species readily distinguished by its fewer, linear or linear-oblanceolate leaflets and long tassel of free filaments.

While *D. emarginata* is properly described as monocarpic, some individual plants, such as one with nearly one hundred stems collected by Mosquin (*no. 5532*, NY) on Galveston Island, and others that I observed in Llano County (*Ripley & Barneby 13,534*), mostly in bud or in young flower late in October, might easily be mistaken for perennial of short duration. Apparently the average plant starts growth in summer and, if conditions are favorable, will flower once in the fall months and again, or without serious interruption, through the early months of the following year. The orange root finally becomes somewhat indurated, but the flowering stems all arise from a single root-crown situated above level of the soil. The habit is not essentially different from the supposedly perennial *D. obovata.*

The species was first discovered by Schiede and Deppe, January 29, 1820, on the shore of the Gulf of Mexico near Tecolutam, Veracruz (near lat. 20° 30′ N), but for some reason the specimens were not worked out. The taxonomic history dates from Thomas Drummond's first Texan collection, parts of which were distributed by Sir William Hooker under an unpublished name honoring Drummond. The holotype was, however, communicated unidentified to John Torrey who in collaboration with Gray published the first description in 1838.

IIIB (iii). Ser. Polygonoides

Annual herbs with terete stems, usually of low stature (0.5–3.5 dm); *terminal leaflet* sessile, forming with the last pair an exact trefoil; *interfloral bracts* persistent; *epistemonous petals* perched well below separation of the short filament tassel, the blades of the inner pair adherent; *androecium* 6–10-merous. — Spp. 2, of s. and w. Mexico (temperate zones of Transverse Volcanic Belt and Sierra Madre Occidental), 1 extending into s.-w. United States.

Dalea subgen. **Dalea** sect. **Dalea** ser. **Polygonoides** (Rydb.) Barneby, stat. nov., based on *Parosela* subgen. *Euparosela* XIII. *Polygonoides* Rydb., N. Amer. Fl. **24**: 74. 1920, quoad typ., char. mut. — Sp. lectotypica: *Parosela polygonoides* (Gray) Rydb., = **Dalea polygonoides** Gray.

Rydberg's small group *Polygonoides* was extremely heterogeneous and unnatural, including besides the typical species *P. fissa* (= *Dalea cyanea* var. *fissa*), a perennial with large flowers of the parosela type, and *P. bigelovii*, here interpreted as a juvenile form of *D. leporina*. Differently circumscribed, ser. *Polygonoides* consists of two species very similar in habit of growth, but nevertheless strongly characterized by features of pubescence, glands, and floral structure.

25. DALEA THOUINI Schrank
(Plate XLVII)

Slender annuals (0.7) 1–3.5 (4.5) dm tall, glabrous to the silky-barbate spikes, when depauperate with 1 erect monocephalous stem, but commonly branching either from below or above the middle, each branch monocephalous, the stems striate but not coarsely angulate, minutely microtuberculate, the foliage bicolored, the leaflets vivid yellowish-green above, blue-green beneath, *minutely black-punctate on both sides*; *leaf-spurs* 0.4–1.5 mm long; *stipules* narrowly lance-acuminate or triangular, 1–3 mm long, with narrow, pallid or papery-castaneous margins; *post-* and *intra-petiolular glands* minute or obsolete; *leaves* (0.6) 1–4 cm long, shortly petioled, with narrowly margined rachis and 2–4 (5) pairs of oblanceolate to narrowly obovate, emarginate, flat leaflets (3) 5–12 mm long; *peduncles* (0.5) 1–9 cm long; *spikes* moderately dense, narrowly ovoid to cylindroid, without petals (7) 8–10 cm diam, the pilosulous axis (5) 9–35 mm long; *bracts* persistent, 2.7–4.5 mm long, dimorphic, the lowest ovate-elliptic to ovate and acute, dorsally glabrous, glabrate beyond the middle, or rarely thinly pilosulous, within densely white-silky, the rest narrower, lance-acuminate or -caudate, pilosulous both sides, all livid-black or -green, obscurely or minutely gland-sprinkled; *calyx* (3.1) 3.3–4.2 mm long, silvery-pilose with ascending, finally spreading hairs, the tube 1.5–1.9 mm long, recessed behind the banner, the subfiliform ribs blackish, the hyaline intervals charged with 1 row of ± 3 minute glands, the teeth narrowly subulate from a deltate-triangular base, (1.5) 1.7–2.3 mm long, gland-spurred, plumose; *petals* dull purplish-blue, all sprinkled and the banner often tipped with tiny glands, the banner longest, at full anthesis overtopping the epistemonous petals, these perched ± 0.8–1 mm above the hypanthium, the inner pair adherent by narrowly overlapping margins, slightly shorter than the filaments; *banner* 3.6–4.2 mm long, the claw 1.3–1.6 mm long, the erect, broadly ovate, shallowly emarginate blade 2.3–2.7 mm long, 1.8–2.3 mm wide; *wings* (1.7) 2.2–2.8 mm long, the claw 1.3–1.6 mm, the oblanceolate, scarcely oblique blade (1.2) 1.4–2 mm long, 0.7–0.8 mm wide; *keel-petals* 2.7–3 mm long, the claw 0.8–1 mm, the narrowly oblong-oblanceolate, scarcely auriculate blades 1.8–2.3 mm long, 0.6–0.7 mm wide; *androecium* 10-merous, 3.6–4.7 mm long, the longer filaments free for 0.5–0.8 mm, the connective minutely gland-tipped, the anthers 0.25–0.3 mm long; *pod* ± 2.5 mm long, obliquely obovoid, the style-base lateral, hyaline in lower ⅔, thinly papery distally, the blackish, filiform prow pilosulous; *seed* ± 2 mm long; 2n = 14 (Mosquin). — Collections: 15 (vi).

Cool rocky slopes and moist flats or hollows among bunch-grass in the pine and pine-oak belts, mostly 2530–3330 m (7600–10,000 ft), but in Morelos (Sierra de Tepoztlán) descending on pedregal as low as 1870 m (5600 ft), local but forming colonies, known from two widely disjunct areas, one on the divide between Mexico (Estado and Distrito Federal) and Morelos (Sierra de las Cruces, Serranía de Ajusco, and vicinity), the other on or near the divide of the Sierra Madre Occidental in w.-centr. Durango (El Salto and w.-ward). — Flowering September to November. — *Representative*: MORELOS. Tepoztlán: *Ripley & Barneby 14,553* (CAS, NY); Huitzilac: *Ripley & Barneby 14,526* (CAS, DAO, MEXU, NY, US). MÉXICO (D. F.). Delegación de Tlalpán: *Matuda 21,947* (MEXU, NY). MÉXICO (Edo.). Ocuilán de Arteaga: *Matuda 25,589* (MEXU, NY); Toluca: *Pringle 5256* (ENCB, MEXU, US). DURANGO. El Salto: *Ripley & Barneby 13,975* (BM, CAS, GH, MEXU, MICH, NY, US), *14,169* (CAS, DAO, MEXU, NY, US).

Dalea thouini (André Thouin, 1747–1824) Schrank, Pl. Rar. Hort. Monac. **1**: 9, cum tab. 1817 ("*Thouini*"). — "Missa sunt semina a celeb. Thouinio..." — Named from cultivated specimens of unstated origin, but presumably first grown in Paris, doubtless from seeds collected in Mexico. — No spm. found at M, P, or Z, the cited plate accepted provisionally as holotypus. — *Parosela thouini* (Schrank) Rydb., N. Amer. Fl. **24**: 78. 1920. *P. leporina* var. *thouini* (Schrank) Macbr., Contrib. Gray Herb. New Ser. **65**: 17. 1922.

In its annual root, glabrous foliage, and narrow, softly gray-silky spikes of inconspicuous flowers, *D. thouini* resembles the much commoner *D. leporina* and has been unnecessarily confused with it. It differs in having only 2–4 (not 8–many) pairs of leaflets even in the primary cauline leaves, and especially in its persistent interfloral bracts, livid-black but almost glandless externally and densely white-silky within. Internally pubescent bracts are found here alone among annual species of the genus. Few leaflets and persistent bracts are features common to *D. thouini* and the more nearly related *D. polygonoides*, but the bracts of the latter are glabrous within and charged outside with a few exceptionally large and lustrous blister-glands.

I have followed Ryd berg's interpretation of the nomenclature, which may nevertheless need revision if any original material, grown either by Thouin at Paris or by Schrank at Munich, can be located. Schrank's rather crude plate and short description suggest no other known species, but do not show the decisive critical features of the species here treated. I find no record of the introduction of *D. thouini* to European gardens, but growing as it does along the old coach road over the mountains between Mexico and Cuernavaca it has been within easy reach of travellers from early times.

The bicentric dispersal of *D. thouini* is rather remarkable for an annual herb, although it is nearly matched by that of the also annual *D. obreniformis*. Intermediate stations for these two species, as also for races of *D. urceolata* intermediate between var. *urceolata* and var. *tripetala*, are to be sought in southern Sierra Madre Occidental and in the mountains of Jalisco.

26. DALEA POLYGONOIDES Gray
(Plate XLVII)

Slender annuals, glabrous to the inflorescence, 0.5–3 dm tall, when depauperate simple and monocephalous but usually branched from the base upward or the stems simple from the base and branched only distally, purplish at base becoming green and angular upward, sparsely glandular-verruculose, the foliage of rather thick texture, the leaflets green above, pallid and punctate beneath; *leaf-spurs* up to 0.5 mm long, sometimes subobsolete; *stipules* subulate to subulate-caudate, 0.6–2 mm long, mostly livid or brownish; *intrapetiolular glands* confluent into a single, subulate or triangular spicule up to 0.3 mm long; *post-petiolular glands* hemispherical, prominent, yellow or orange; *leaves* (0.7) 1–3 cm long, slender-petioled, with narrowly margined, usually sparsely glandular rachis and (1) 2–3 (4) pairs of narrowly oblong-oblanceolate, emarginate or retuse leaflets 5–12 (15) mm long, the terminal one longer than but arising at the same point as the last pair, all easily and quickly reflexed at dusk or when picked; *peduncles* mostly 1.5–7 (15) cm long, subobsolete in some young or depauperate individuals; *spikes* at anthesis moderately dense, becoming looser in fruit, at first ovate in outline, becoming ovate-oblong to cylindric, without petals 5.5–8 (9) mm diam, the thinly pilosulous or glabrous axis becoming (5) 8–25 (30) mm long; *bracts* persistent, subdimorphic, the lowest broadly obovate-flabellate to rhombic-ovate, short-acuminate, 2–4 mm long, the interfloral ones narrower, rhombic-oblan-

ceolate to -spatulate, pallid and membranous in the proximal ½–⅓, livid distally and charged dorsally with a few large, orange or pale yellow glands, all glabrous dorsally and ciliolate, or the upper ones sometimes thinly pilosulous dorsally; *calyx* at anthesis 2.8–4 mm long, distended and slightly accrescent in fruit, thinly pilose externally with silvery hairs or the tube glabrous and only the teeth and orifice pilose-ciliolate, the tube recessed behind the banner, at first obconic-campanulate 1.6–2.1 mm long, 1.2–1.6 mm diam, pleated at base, the ribs slender but prominent, usually livid, the intervals hyaline, charged with 1 (2) large orange glands, the livid teeth triangular-aristate, gland-spurred, 1.3–2 mm long; *petals* pale rose-purple, eglandular or the banner charged with a few tiny, scattered glands, the wings and keel early deciduous, perched well below separation of the filaments; *banner* 2.7–3.8 mm long, the claw 1.1–1.8 mm, the flabellate blade 1.4–2.3 mm long, 1.2–1.5 mm wide; *wings* 2–2.5 mm long, the claw 0.8–1.1 mm, the narrowly oblanceolate, minutely auricled blade 1.3–1.6 mm long, 0.3–0.6 mm wide; *keel* (2) 2.4–2.9 mm long, the claws 0.8–1.5 mm, the half-obovate blades 1.3–1.9 mm long, 0.7–1 mm wide; *androecium* (6) 7-9-merous, 2.2–3.5 mm long, commonly with only 5 fertile members, the rest with effete or greatly reduced anthers, the longer filaments free through 0.45–0.7 mm, the connective minutely gland-tipped, the fertile anthers nearly round in outline, ± 0.2 mm diam; *pod* exserted from the calyx-tube, obliquely obovoid-pyriform in profile, 2.5–3 mm long, the style-base lateral, the filiform prow strongly convexly arched, livid-nigrescent, the valves hyaline proximally, thinly papery, pilosulous but not glandular distally; *seed* 1.5–1.9 mm long; $2n = 7_{II}$ (Mosquin). — Collections: 33 (ii).

Open slopes and grassy or gravelly flats in pine-forest, 1950–2770 m (6500–8300 ft), local but forming colonies, widespread around the upper watershed of the Gila River in centr. and s.-e. Arizona (Yavapai to s. Apache, Greenlee, and Cochise Co) and s.-w. New Mexico (Catron, Grant, and w. Sierra Co.), e. in New Mexico to the s. end of Sangre de Cristo Mts. (San Miguel Co.) and White Mts. (Lincoln Co.)., the Davis Mts. in trans-Pecos Texas, and s. (as now known seemingly interruptedly) along Sierra Madre Occidental to w.-centr. Durango. — Flowering September–October. — *Representative*: UNITED STATES. ARIZONA. Yavapai: *Goodding 88-46* (NY). Coconino: *Deaver 6067* (NY). Apache: *Gould & Robinson 5-80* (UC). Pima: *Shreve 5408* (UC). Greenlee: *Pinkava et al. 13,657* (NY). Cochise: *Blumer 1652* (L, NY, W). NEW MEXICO: Catron: *Metcalfe 463* (NY, UC). Sierra: *Metcalfe 1410* (NY, UC, WIS). Grant: *Rusby 84* (NY). San Miguel: *Rose & Fitch 17,600* (NY). Lincoln: *Wooton 525* (NY). TEXAS. Jeff Davis: *Correll 33,767* (RENNER). MEXICO. CHIHUAHUA. Madera: *A. S. Leopold 245* (UC). Ciudad Guerrero: *Pringle 1213* (F, NY, MEXU). DURANGO. V. Ocampo: *Reveal & Hess 3101* (NY). Durango: *Mosquin 6829* (NY). El Salto: *Ripley & Barneby 13,984* (CAS, DS, NY).

Dalea polygonoides (resembling some annual knotgrass) Gray, Pl. Wright. **2**: 39. 1853. — "Pebbly bed of mountain torrents, near the copper mines, New Mexico [= Santa Rita, Grant Co.], Oct., in fruit (991)." — Holotypus, collected by Charles Wright in 1851, GH! isotypus, NY! — *Parosela polygonoides* (Gray) A. Heller, Catal. N. Amer. Pl., ed. 2, 6. 1900.

Dalea hutchinsoniae var. *anomala* Jones, Extr. from Contrib. West. Bot. **18**: 42. 1933. — "Chiricahua mts., Ariz. in Rustlers' Park, Sept 22 1931..." — Lectotypus (Morton, l.c. infra): *Jones, s. n., POM no. 187431*, POM! — *D. polygonoides* var. *anomala* (Jones) Morton, Contrib. U. S. Nat. Herb. **29**: 102. 1945.

Dalea polygonoides var. *laevituba* (smooth-tubed, of the externally glabrous calyx) Kearn. & Peeb., Jour. Wash. Acad. Sci. **29**: 483. 1939. — "Type: *Harrison, Kearney, &*

Fulton 8089, Santa Catalina Mountains, Pima County, Ariz., August 23, 1931..." — Holotypus, US!

Within the known range of *D. polygonoides* there are only two annual daleas with persistent bracts that might be confused with it, *D. exigua* and *D. confusa*, both of which are distinguished by the presence of at least a few fine spiral hairs along the margins of the leaflets. A sympatric species with glabrous foliage, *D. filiformis*, has early deciduous bracts and truly filiform leaflets. At the south limit of its range in Durango *D. polygonoides* occurs withina few miles of the closely related *D. thouini*, like it in foliage but easily distinguished by the nigrescent bracts almost eglandular externally and white-silky inside.

The species varies considerably in stature, the smallest individuals growing in poor stony soil being reduced sometimes to a single stem with one terminal flower-head while others, better nourished, become several times branched and many-headed. Exaggerated notice has been accorded the variant with glabrous calyx-tube, which occurs in the same population as the nomenclaturally typical form with externally pubescent calyx (cf. *Barneby 5099*, NY), and where segregated from this, has not acquired a distinctive or continuous range. I therefore list var. *anomala* and var. *laevituba* as exact synonyms.

IIIB (iv). Series Urceolatae

Annual herbs, variable in stature, with subterete, striate, or obtusely ribbed stems, glabrous below the flower-spikes; *terminal leaflet* sessile, forming with the adjacent pair an exact trefoil; *spikes* moderately dense; *interfloral bracts* deciduous by anthesis (the lowermost often persistent); *epistemonous petals* perched well below separation of the short filament tassel, the blades of the inner pair (sometimes lacking) either free in vernation or marginally overlapping and adherent; *androecium* 5–10-merous. — Spp. 4, all Mexican, all but 1 of wide dispersal, either extending into s.-w. or centr. United States, or s. into Central America, 1 naturalized on the Bolivian plateau and in adjoining Chile and Argentina.

Dalea subgen. **Dalea** sect. **Dalea** ser. **Urceolatae** (Rydb.) Barneby, stat. nov., based on *Parosela* subgen. *Euparosela* XI. *Urceolatae* Rydb., N. Amer. Fl. **24**: 73. 1920. — Sp. typica: *P. urceolata* (Greene) Standl. = **Dalea urceolata** Greene var. **urceolata**.

Parosela subgen. *Euparosela* X. *Lagopodes* Rydb., N. Amer. Fl. **24**: 72. 1920, max. pro parte (exclus. *P. lagopina*). — Sp. typica: *P. lagopus* sensu Rydb. (non *P. lagopus* Cav. vera) = **Dalea exserta** (Rydb.) Gentry.

Parosela subgen. *Euparosela* XIII. *Alopecuroides* Rydb., N. Amer. Fl. **24**: 75. 1920, pro parte, exclus. spp. plur. — Sp. typica: *P. alopecuroides* (Willd.) Rydb. = **Dalea leporina** (Ait.) Bullock.

The ser. *Urceolatae*, as redefined above, consists of four species, the three commoner ones corresponding with elements of three Rydbergian series of *Euparosela*: *Lagopodes, Urceolatae* (sens. str.), and *Alopecuroides*. It includes the typus of each group, and it might seem preferable to have taken up one of the two epithets based on old species widely known rather than on the relatively rare and recently described *D. urceolata*. The epithet *Lagopodes* was rejected because its typus, *P. lagopus* sensu Rydb., is not the original *P. lagopus* of Cavanilles (which = *D. leporina*) but the species treated herein as *D. exserta*. The ser. *Alopecuroides* was so loosely defined by Rydberg that it came to include members of four gropus, two of them referred in these pages to subgen. *Dalea* and two to subgen. *Parosela*. Only three of the eleven species admitted by Rydberg, namely *P. leporina, P. alopecuroides,* and *P. costaricana*, all now evaluated as taxonomic synonyms of *Dalea leporina* Ait., belong to the group under discussion, so that it seemed best to abandon the epithet along with the concept of a ser. *Alopecuroides.*

27. Dalea leporina (Aiton) Bullock
(Plate XLVIII)

Erect annual herbs (1.5) 2.5–10, rarely 8–15 dm tall, glabrous to the spikes, when depauperate simple and monocephalous but more often paniculately branching from above, near, or below the middle, the widely or strictly incurved-ascending branches either simple or again branched, the primary axis usually smooth and stramineous at base, becoming green or purplish, striate, and ± sparsely (rarely densely) glandular-verruculose distally, the foliage green, the leaflets smooth above, commonly paler and always punctate beneath; *leaf-spurs* 0.4–1.6 mm long; *stipules* subulate, 1–3 mm long, brownish or livid becoming dry and fragile; *intrapetiolular glands* usually spiculiform; *post-petiolular glands* hemispherical or mammiform, prominent, pale yellow or orange; *leaves* 2–9.5 cm long, shortly petioled or subsessile, the rachis narrowly green-margined, sulcate ventrally, the main cauline ones with (8) 10–17 (24), the rameal ones (rarely all of some dwarf individual plants) often only 4–10 pairs of oblanceolate, oblong-oblanceolate, or obovate, emarginate or retuse, exceptionally obtuse leaflets (2) 3–12 mm long, these flat and relatively thin-textured in more mesic habitats, loosely folded, thicker, often red-margined in more xeric ones; *spikes* terminal to the main axis and all branches, the latter often over-topping the former, pedunculate, the peduncles (1.5) 3–12 (15) cm long, the spike itself moderately dense, narrowly ovoid becoming cylindroid, without petals or androecia 8–12 (15) mm diam, the pilosulous axis finally (0.8) 1.5–7 (10) cm long; *bracts* all deciduous or the lowest ones subpersistent, ovate to lance-acuminate or abruptly caudate, 2.5–7 mm long, the lowest glabrous or subglabrous and glandular dorsally, the interfloral ones ± pilosulous and ciliolate, the body and tail varying in color from pale green to greenish- or blackish-purple; *calyx* 3–5.2 (6.5) mm long, thinly to densely pilose-pilosulous from base upward with fine, ascending hairs, the tube (1.7) 2–2.5 (2.8) mm long, recessed behind the banner, the ribs filiform, brown or livid-nigrescent, the intervals membranous, flat or nearly so, charged with 2 ± irregular rows of small orange blister-glands (sometimes confluent into 1 row of ± large elliptic ones), the broadly ovate-triangular and apiculate to lance-acuminate, often but not always gland-spurred teeth 1–2.8 (4) mm long; *petals* most commonly milky-white to bright bluish-purple or nearly blue, in some races white, all eglandular or the banner rarely gland-tipped, the epistemonous ones perched 1.2–2.8 mm below separation of the short filament-tassel, readily deciduous on expansion; *banner* (3.4) 4.4–6 mm long, the claw 1.7–3 mm, the ovate and basally angled to oblong-elliptic, erect blade (1.7) 2–3.7 mm long, 1.2–2.4 mm wide; *wings* (1.6) 1.9–3 mm long, the claw 0.3–0.9 mm, the oblanceolate or oblong-elliptic blade not or obscurely auricled at base, (1.3) 1.6–2.4 mm long, (0.4) 0.5–0.9 mm wide; *keel* 2.1–3.1 (3.5) mm long, the claws 0.5–1.1 mm, the blades like those of the wings but sometimes broader and more oblique, 0.7–1 mm wide; *androecium* 9–10-merous, 5–6.8 mm long, the filaments free for 0.6–1 mm, distally whitish or blue-purple, the connective gland-tipped, the pallid or dark blue anthers (0.2) 0.25–0.35 (0.4) mm long; *pod* obliquely obovate in profile, 2.4–3 mm long, the style-base lateral, the filiform, often livid or brownish prow strongly convex-arcuate, the valves hyaline in the lower ¾, thinly papery, pilosulous, and sometimes finely gland-sprinkled around the distal margin, when fully ripe dehiscent through the ventral and distally through the dorsal suture; *seed* 1.7–2.4 mm long; n = 7_{II} (Spellenberg, 1973; Mosquin), 2n = 14 (Mosquin). — Collections 248 (xiv).

A weedy species, found in disturbed soils along highways, at edge of fields, on stream-banks and lake-shores, northward (formerly, now much depleted) on virgin

prairie, southward in savanna, arid grassland, thorn-scrub, and open oak- and pine-forest, reaching 2400 m in Durango but mostly lower, locally plentiful over the greater part of interior Mexico (exclusive of Yucatan peninsula) and upland Guatemala; Costa Rica (to be expected in Honduras and Nicaragua); n., e. of the Continental Divide, through New Mexico and trans-Pecos Texas to s.-centr. and s.-e. North Dakota, e. (in scattered stations, mostly riparian) to Minnesota, w.-centr. Indiana, the Mississippi valley in s.-e. Missouri, and centr. Texas (Brown Co.), extending from s. New Mexico w. of the Divide into the Gila basin in centr. and s.-e. Arizona and adjoining Sonora; also disjunctly, along roads, in fields, and in waste places about villages and cities of the arid centr. Andean plateau, at ± 2250–2850 m, in s.-e. Chile (Apurimac and Puno), through Bolivia from Lago Titicaca s.-e. into n.-w. Argentina (Jujuy, Salta, and Tucumán). — Flowering in N. hemisphere August to December, in S. hemisphere February to May.

Dalea leporina (Ait.) Bullock, Kew Bull. **1939**: 196. 1939 (jun), based on *Psoralea leporina* (of hares, from the softly silky spikes) Ait., Hort. Kew. **3**: 81. 1789. — "ex hort. Kew., 1780", BM! — *Parosela leporina* (Ait.) Rydb., N. Amer. Fl. **24**: 78. 1920. *Dalea leporina* (Ait.) Kearn. & Peeb., Jour. Wash. Acad. Sci. **29**: 483. 1939 (nov), as comb. nov., but antedated by Bullock, supra.

Psoralea lagopus (hare's-foot, of the spikes) Cav., Icones **1**: 59, tab. 86. 1791. — "Habitat in Mexico...Vidi floridam mense Novembri in...horto Regio Matritensi..." — Holotypus, labelled "*Psoralea lagopus* vulgo Terciopelillo", MA (herb. Cav., 3 sheets)! — *Dalea lagopus* (Cav.) Willd., Sp. Pl. **3**: 1340. 1802 ("*Lagopus*"), comb. illegit. *Parosela lagopus* (Cav.) Cav., Descr. Pl. 187. 1802.

Dalea alopecuroides (resembling fox-tail grass, of the spikes) Willd., Sp. Pl. **3**: 1336. 1802. — "*Habitat in* America boreali..." — Holotypus not examined. Willdenow had living material cultivated at Berlin ("v. v."), probably from seed collected by Michaux. Photographs (NY, alibi) of a spm. in herb. Willd., derived from Bellardi, said to be phototypes, are correctly named. — *Psoralea alopecuroides* (Willd.) Poir. in Lamk., Encycl. Méth. **5**: 695. 1804. *Petalostemon alopecuroides* (Willd.) Pers., Syn. Pl. **2**: 268. 1807; Pursh, Fl. **2**: 461. 1814.

Dalea linnaei (Carl Linnaeus, 1707–1778) Michx, Fl. Bor.-Amer. **2**: 56, tab. 38. 1803. — No locality given, but from context N.-E. United States. — Holotypus, labelled "Amer. Sept., *Michaux*", P (herb. Michx.)! isotypi, NY (herb. Torr., fragm.), P (herb. L. C. Rich.)! — Despite the epithet, not *Dalea* of Linnaeus, which = *D. cliffortiana*.

Dalea annua δ *ebracteata* (the bracts early cast off, in contrast to *D. cliffortiana*) O. Kze., Rev. Gen. 178. 1891. — No locality given and no spm. survives, so named, in herb. Kunze. (NY).

Parosela bigelovii (John Milton Bigelow, 1804–1878) Rydb., N. Amer. Fl. **24**: 75. 1920 ("*Bigelovii*"). — "Type collected near the Copper Mines (Santa Rita del Cobre), New Mexico, *Bigelow, Mexican Boundary Survey 226*, in part." — Holotypus, as indicated, US! — *Dalea bigelovii* (Rydb.) B. L. Turner, Field & Lab. **18**: 47. 1950.

Parosela costaricana (of Costa Rica) Rydb., N. Amer. Fl. **24**: 77. 1920. — "Type collected at Haciendas de Zent and de Guacimo, Costa Rica, *United Fruit Company 21...*" — Holotypus, US!

Petalostemum oreophilum (mountain-loving) Cory, Rhodora **41**: 561. 1939. — "...along Boot Creek...in the Chisos Mountains...by the writer, September 26, 1938..." — Holotypus, *Cory 30,392*, not found at GH; isotypi, TEX, US! *Dalea oreophila* (Cory) Cory, Rhodora **49**: 164. 1947.

Dalea leporina var. *alba* (white) Harrington, Man. Pl. Colo. 641. 1954, based on *D. alba* Michx. ex Roem., Cat. Hort. Bot. Soc. Phys. Turic. 1802, nom. nud.

The Hare's-foot Dalea or Terciopelillo ("little velvet") is the most widely dispersed species of its genus. In North America it spans nearly 35° in latitude, and reappears, probably as a denizen of long standing, on the arid plateaux of the interior middle Andes. The species is so well and so widely known that I judge it superfluous to cite representative collections, and will confine my remarks to commentary on intraspecific variation and its repercussion in the synonymy.

The individual plant of *D. leporina* is an annual of relatively long duration. The seed germinates with the onset of warm weather or, southward, with early summer rainfall, but flower buds do not form until the equinox approaches, and full anthesis is generally delayed until late August or September, continuing, northward, until frost and, southward, until drought rather than frost puts an end to active growth. Accidents of microhabitat and nutrition play large roles in determining stature of the plant, which may be simple and monocephalous, due to abortion of all axillary branchlets, or paniculately branched from near the base or only from well above the middle. The spikes of calyces are usually about one centimeter in diameter, but occasional *gigas* individuals (e.g. *Ripley & Barneby 14095*, NY) with spikes up to 1.5 cm thick have been encountered among more ordinary forms. The cauline leaves that develop during the season of long days are relatively elaborate, with many (mostly 10–17) pairs of leaflets; they are commonly drought-deciduous, giving way distally to shorter simpler leaves which develop with the flowers during the season of shorter days and longer nights. A form found in pine forest of the northern Sierra Madre in Mexico and southern New Mexico is characterized by stems uniformly short and slender. It passes directly from the seedling stage to the flowering stage, dispensing with the larger cauline leaves. The extreme phase of this perhaps taxonomically significant form, which was recognized by Rydberg as *Parosela bigelovii*, may have as few as 5–7 pairs of leaflets in even the larger leaves (cf. *Ripley & Barneby 13967*, NY), but is linked to the main series by intermediates. Rydberg (1920, p. 68 in key, p. 75) associated (and so contrasted) *P. bigelovii* not with its really close ally *P. leporina* but with *P. polygonoides*, thereby conferring on it a spurious air of distinction. According to Rydberg the calyx of *Dalea leporina* should differ from that of ser. *Polygonoides* in its symmetrically cleft tube, but in reality its adaxial sinus, like that of *D. polygonoides* itself, is always more or less deeply recessed behind the banner. Experimental cultures are needed to determine whether the loss of large cauline leaves in *P. bigelovii* is genetically or environmentally controlled.

Two other seemingly trivial types of variation were unduly emphasized in Rydberg's revision: density of lens-like glands on the stems and coloring of the petals and androecium. A phase with relatively many glands, but in no other way different from ordinary Mexican *D. leporina*, was described as *P. costaricana*, a negligable segregate. The color-variants have had a longer history.

Over most of its range southward from extreme southwestern United States the petals of *D. leporina* are blue, but vary in depth of coloring from a pale milky shade to a rich and pure azure or a bluish-lilac, heavily pigmented petals being accompanied normally by dark green leaves and a blue or lurid tassel of filaments, which becomes conspicuous after the early fall of the petals themselves. Northward and northeastward from the latitude of middle New Mexico the petals are normally white or (fresh) faintly blue-tinged, the tassel whitish, and foliage of a brighter, fresher green, as though from a general depletion of anthocyanin. Rydberg's *P. leporina* and *P. alopecuroides* correspond with these southern and northern variants, which are not otherwise perceptibly different, even though they show a fair measure of geographic segregation. In northern Mexico the distinction does not seem viable, for white and blue flowers may occur in one small colony of plants (*Ripley & Barneby 14,168*, NY) and white petals can surround either a white or a blue tassel. For those who may choose to distinguish the two forms at the infraspecific level there is unfortunately no valid name at present available, the *D. leporina* var. *alba* of Harrington, designed for the northern variant, being technically unacceptable. Harrington seems to have taken the synonymy from Rydberg, but failed to note Rydberg's cautious

note of interrogation when he cited *D. alba* Michx. in the synonymy of *Parosela alopecuroides*. Rydberg cannot have actually seen the rare pamphlet, a seedlist issued in Zurich by J. J. Roemer, in which *D. alba* appears merely as a nomen nudum, not attributable with any security to a particular species. Michaux had a few years previously introduced to European gardens not only the annual white-flowered *D. leporina*, which he (or L. C. Richard) confused with the Dalea of Linnaeus and rechristened *D. linnaei*, but also the white-flowered perennial *Dalea* (or *Petalostemum*) *candida*, which may just as easily have been the plant in cultivation in Zurich. Nor can *D. leporina alba* be taken up as a new name dating from Harrington's Flora of Colorado (1954), for it lacks there a validating diagnosis.

The confusion between *Dalea leporina* and *D. cliffortiana* which lasted from Michaux to modern times, even though the two entities were explicitly separated by Willdenow, has been recounted elsewhere (Barneby, 1965). The first dissent is found in Kunze's *Revisio Generum*, where they were distinguished at varietal level, the *D. annua ebracteata*, listed above, being separated from genuine *D. annua* (= our *D. cliffortiana*) by its deciduous interfloral bracts.

Attention must be drawn to my reinterpretation of *Psoralea lagopus* Cav. which Rydberg, not having seen the type, misunderstood. transferring the name (as *Parosela lagopus*) to the related species treated below as *D. exserta*. It is a curious coincidence that Aiton and Cavanilles should have invented, almost simultaneously, for the same species independently introduced to cultivation in London and Madrid, epithets so similar in meaning as *leporina* and *lagopus*. However, the softly silky spike of calyces, to which the tiny evanescent petals contribute little in the way of ornament, is obviously the feature that first strikes the eye. The vernacular *terciopelillo*, recorded by Cavanilles and still current on the Mexican plateau, has a cognate origin.

The synonym *D. pedunculata* Pursh, confidently referred by Rydberg to the synonymy of *P. alopecuroides*, is mentioned in this account as unidentified (Appendix I).

All of the foregoing remarks refer to *D. leporina* as found in North America. The Andean populations are less well documented by herbarium material, but we have enough to know that although less variable overall than those of Mexico they are not homomorphous. The calyx-teeth, for example, vary in length, just as northward. In Bolivia the lowermost bracts tend to be relatively long-tailed, and the glands in the calyx-membranes are more often than elsewhere confluent into a vertical row of 2–3 narrowly elliptic lenses. However the latitude of variation lies entirely within that already recognized in Mexican races of the species, and it seems rational to suppose that *D. leporina* is not aboriginally native in the southern hemisphere. The earliest record that I have seen is that of Pearce, who collected specimens "in cultis" at Tarija in 1864. All stations since recorded lie on or near the main Andean highway that runs from Abancay in Peru by way of Cuzco, Sicuani, La Paz, Oruro, Sucre, and Tarija into northwestern Argentina. Burkart (1952, p. 253, as *D. alopecuroides*) accepts the species as native in Argentina, but taking into account the weedy potential of *D. leporina* amply documented in North America and the fact that all other members of subgenus *Dalea* are confined to the northern hemisphere, its disjunct Andean range seems to be of adventive nature. One collection from Cochabamba, Bolivia (*Buchtien 2383*) has been distributed under an unpublished name ("*lucidocarpa*") attributed to H. H. Rusby. The plants (NY, US) are in advanced fruit and interesting because they clearly show the dehiscence of the pod by separation of the valves along the adaxial suture.

Beyond the range described above, *D. leporina* has appeared as a fleeting ruderal near New York and in coastal Massachusetts (Snyder, Rhodora **52**: 299. 1950), but is not known to have become established in the Atlantic states.

The holotypus of *Petalostemon oreophilum* could not be located in 1975 at the Gray Herbarium, where Cory stated that he had placed it. A specimen of *D. leporina* preserved there under an unpublished trinomial (*Petalostemon oreophilum* var.) was collected in Limpia Canyon n.-e. of Fort Davis 28 September 1942 (*Cory, s. n.*) and was perhaps deposited at GH by mistake.

28. Dalea exserta (Rydberg) Gentry
(Plate XLVIII)

Erect annual herbs, commonly robust and coarse, up to (5) 6–10 (12) dm, exceptionally only 1.5 dm tall, glabrous to the inflorescence, the greenish, stramineous, or purple-tinged, ribbed, distally gland-verruculose stem simple at base, exceptionally monocephalous, usually branching upward from below or near the middle, the branches mostly terminating in a spike, the foliage green or subglaucescent, the leaflets smooth above, punctate beneath; *stipular spurs* up to 1 mm long, the blades triangular-subulate, subglandular, up to 1.5 mm long; *intrapetiolular glands* 2, spiculiform, deciduous; *post-petiolular glands* small but prominent; *leaves* somewhat dimorphic, the main cauline ones (drought-deciduous) 3–10 cm long, shortly petioled, with narrowly margined rachis and 9–18 pairs of oblong-elliptic to oblanceolate, obtuse and gland-mucronulate or emarginate leaflets 2–9 mm long, the uppermost leaves and leaflets smaller; *peduncles* rather stout, (1) 2.5–14 cm long; *spikes* moderately dense, oblong-ovoid becoming oblong-cylindroid, without petals or androecia (12) 13–16 mm diam, the villosulous or distally glabrous axis becoming (1.5) 2–8 cm long; *bracts* (3) 4–8 mm long, subdimorphic, the lowest commonly persistent, ovate- to broadly lance-caudate, the rest narrower but otherwise similar, early deciduous, all membranous-margined proximally, dorsally glandular, livid, and glabrous or nearly so, eciliate; *pedicels* 0–0.2 mm long; *calyx* at anthesis 4.8–7 mm long, narrowly turbinate, but somewhat accrescent and finally subtumid and oblong-ovoid, the tube (2.5) 2.7–3.8 mm long, glabrous or nearly so externally, deeply recessed behind the banner, the subfiliform ribs either livid or stramineous, the broad, glossily membranous intervals charged with 1–2 rows of ± 4 linear-elliptic, golden or orange blister-glands, the teeth triangular-aristate, (2) 2.3–3.8 mm long, usually about as long or slightly longer than the tube, rarely up to 0.6 (1) mm shorter, all plumose-ciliate with fine spiral rufescent hairs; *petals* all blue, or bicolored, the banner then opening white but early violascent, all or only the banner gland-tipped, the inner pairs inserted near or below middle of androecium, the keel-blades usually adherent by their narrowly overlapping exterior margins; *banner* 4.9–7.3 mm long, the claw 1.3–2.5 mm, the broadly lance-oblong to oblong-elliptic, obtuse or emarginate, almost erect blade 3–4.8 mm long, 2.2–3.3 mm wide; *wings* (2.8) 3.6–5 mm long, the claw 0.4–0.8 mm, the lanceolate or oblong, shortly auriculate blade (2) 3.4–5 mm long, 1–1.8 mm wide; *keel* 3.9–5 mm long, the claws 0.6–1.3 mm, the lunately elliptic or obliquely obovate blades 3–3.7 mm long, 1.1–1.6 mm wide; *androecium* 8–10-merous, (7.5) 8–11 mm long, the longer filaments purplish distally free for 0.9–1.6 mm, the connective gland-tipped, the pallid anthers 0.4–0.45 mm long; *pod* broadly obovoid-suborbicular, compressed, 2.2–2.8 mm long, slenderly keeled along the ventral and distal margins, the style-base lateral or latero-terminal, the papery-membranous valves charged with minute scattered glands, thinly pilosulous distally, finally dehiscent along the ventral suture; *seed* 1.6–1.8 (2) mm long; 2n = 14 (Mosquin). — Collections: 26 (iv).

Grassy openings in oak-woods, on pedregal in thorn forest, and in disturbed soils along highways and in fallow fields, mostly 1000–1800, perhaps rarely up to 2100 m, descending exceptionally to near 500 m, widely dispersed and locally common but the known stations highly discontinuous: w. slope of northern Sierra Madre Occidental in Chihuahua, adjoining Sonora, and just entering extreme s. Arizona (Santa Cruz County); Balsas Depression and Sierra Madre del Sur from w. Jalisco and Colima to Guerrero and Morelos; Atlantic slope of Mexican Plateau in Veracruz; centr.

Oaxaca (Mixteca Alta); highlands of Chiapas through Guatemala (Alta Verapaz, Chimaltenango, and Guatemala) to Honduras (Morazán); Costa Rica (near Ochomogo and San José). — Flowering August to March. — *Representative*: UNITED STATES. ARIZONA: *Goodding* (Sycamore Canyon near Ruby) *in 1939* (GH, NY). MEXICO. CHIHUAHUA: *Knobloch 5412* (F). SONORA: *Gentry 518* (ARIZ, MICH); *S. S. White 2705* (MICH). JALISCO: *González 186, p. p.* (MICH). COLIMA: cf. type. MICHOACÁN: *Ripley & Barneby 14,794* (CAS, DAO, NY). MÉXICO: *Hinton 2273* (F, K, MEXU, Z), *5048* (F, K, NY, Z). MORELOS: *Ripley & Barneby 14,561* (CAS, NY), *14,564* (CAS, DAO, NY). GUERRERO: *Hinton 9665* (F, NY). VERACRUZ: *Purpus 2348* (F, NY, UC), *15,746* (UC). OAXACA: *Galeotti 3238* (P). CHIAPAS: *Matuda 17,270* (F, MEXU). GUATEMALA. ALTA VERAPAZ: *Türckheim 2050* (NY). GUATEMALA: *Standley 59,256* (F, NY). CHIMALTENANGO: *Standley 59,116, 64,307* (F). HONDURAS. MORAZÁN: *Standley 4023* (F). COSTA RICA. SAN JOSÉ: *Pittier & Tonduz 10,915* (BR, NY).

Dalea exserta (Rydb.) Gentry, Río Mayo Pl. 138. 1942, based on *Parosela exserta* (protruded, of the long androecium) Rydb., N. Amer. Fl. **24**: 73. 1924. — "Type collected at Colima, February 27 and 28, 1891, *Edward Palmer 1312*..." — Holotypus, US!

Dalea elata Mart. & Gal., Bull. Acad. Brux. **10**[2]: 41. 1843. — "Se trouve dans les savanes à hautes graminées de Zacuapan, près Vera Cruz, de 2 à 3,000 pieds." — Holotypus, *Galeotti 3264*, BR (herb. Mart.)! isotypi, BR (herb. Galeott.), G, K, P, W! — Non *D. elata* H. & A., 1840.

Parosela lagopus sensu Rydb. in N. Amer. Fl. **24**: 73. 1924 ("*Lagopus*"). — Non *P. lagopus* (Cav.) Cav., 1802, quae = *D. leporina* (Ait.) Bullock.

This coarse annual dalea is related both to *D. leporina* and *D. urceolata*; it might be visualized as a vigorous version of the former differing in its more massive spikes, externally glabrous calyx-tube, and long, far exserted androecium, from which the inner petals fall away at an early stage of anthesis. In its glabrous, incipiently tumid calyx which becomes more or less obviously ovoid or urceolate in fruit, *D. exserta* resembles *D. urceolata*, the latter's short androecium being the most important, in the last analysis perhaps the only dependable differential character, and it is impossible to evade the question of whether there are two genuinely distinct species. Supposing, by way of hypothesis, that long-stamened populations have arisen more than once from an already polymorphic aggregate defined below as *D. urceolata* sens. lat., the problem of the highly discontinuous range of *D. exserta* would be solved. The populations found in the northern Sierra Madre would emerge as derived directly from var. *urceolata* native, at slightly greater elevations, in the same latitudes, and would be seen to bear the same relation to the latter as the more southern populations of *D. exserta* bear to *D. urceolata* var. *tripetala*. On the Balsas slope of the Neovolcanic Range in México and Morelos *D. urceolata* var. *tripetala* is found principally in cool oak-pine forest at 2000–2500 m, whereas *D. exserta* is encountered normally in a belt below it, mostly below the oak-line. However, near Cuernavaca var. *tripetala* descends the escarpment of Cuesta de Huitzilac onto pedregal within the range of *D. exserta*, and here the only substantial difference between them seems to be length of androecium, weakly supported by different norms of stature. In practice I have found no difficulty in dividing the material of *D. urceolata* and *D. exserta* into two groups and it seems prudent for the present to maintain these at the rank of species, remembering, however, that they are under suspicion and in need of further study.

It is unfortunate that *Dalea elata* Mart. & Gal., the first name proposed for *D. exserta*, is a later homonym, for the collection in which it is based is ample, and characteristic of the species as here defined. The holotype of *Parosela exserta* is much less satisfactory, consisting of a single individual plant collected in advanced fruit late in February at the

low elevation of about 500 m near Colima. Rydberg treated tall, that is essentially normal *D. exserta* of this account under the name *Parosela lagopus* (a taxonomic synonym of *D. leporina*), setting off the new *P. exserta* (sens. str.) by its dwarf stature (± 1.5 dm) and glabrous raceme-axis. Close study of Palmer's plant shows that the pilosulous pubescence found in most tall *D. exserta* is not altogether lacking; fine spreading hairs extend over the last centimeter of the peduncle and upward among the lower flowers, although absent distally. The same condition is found in a tall plant (*Hinton 9665*, NY) from Guerrero, which could not be separated on other grounds from Rydberg's *P. lagopus*. The typus of *D. exserta* does remain, however, quite unusual in the context of this species for its small size. Furthermore I found in one flower, possibly not fully developed, that one pair of the inner petals was suppressed, a feature that I have not seen elsewhere in *D. exserta*, although it is normal in *D. urceolata* var. *tripetala*. Thus the typus of *D. exserta* combines the long androecium which I have emphasized as diagnostic with characters reminsicent of *D. urceolata* sens. lat., raising once again the problem stated in the preceding paragraph.

During the early stages of my study, when I had discovered Rydberg's misidentification of *Psoralea lagopus* Cav. but had not taken the taxonomic step of uniting his *Parosela lagopus* with *P. exserta*, I used on several sheets of this species an unpublished epithet ("*belgarum*," commemorating Martens & Galeotti); some of these annotations I was later unable to rectify, the material having already passed out of my hands.

29. Dalea urceolata Greene
(Plate XLIX)

Slender annual herbs, resembling *D. leporina* in habit, glabrous to the spikes (except for a few hairs high on the peduncle), the stems commonly purplish at base, distally green or stramineous and charged with a few small prominent glands, either branching from near base and the lateral branches then incurved-ascending and often surpassing the central axis, or simple below middle and few-branching upward, all the more vigorous stems and branches monocephalous, the foliage green above, pallid or glaucescent and punctate beneath; *stipular spurs* up to 1 mm long, the blades triangular-subulate, 0.7–1.7 (2) mm long; *intrapetiolular glands* setiform, sometimes minute, brown or livid; *post-petiolular glands* small but prominent; *leaves* 1.5–7 cm long, subsessile or very shortly petioled, with narrowly winged rachis and (3) 5–14 pairs of petiolulate, oblong-oblanceolate, very obtuse to emarginate or retuse leaflets 2.5–9.5 mm long; *peduncles* 0.5–7.5 (12) cm long; *spikes* ovoid-oblong, the larger becoming cylindroid, without petals or androecia ± 9–10.5 mm diam, the thinly pilosulous or glabrate axis becoming 0.8–4 (5) cm long; *bracts* dimorphic, the lowest 2–3 larger, firmer, and more persistent than the rest, the interfloral ones deciduous, broadly ovate -acuminate or -caudate, 2–5 mm long, all glabrous, pallid or livid except for membranous margin, ± gland-dotted dorsally, the body either a little longer or shorter than the tail; *calyx* sessile, before anthesis campanulate, during anthesis becoming ovoid-ellipsoid, a little constricted at the mouth, 3.5–6 mm long, the externally glabrous tube (2.4) 2.6–3.4, in fruit sometimes up to 4.5 mm long, deeply recessed behind the banner, the subfiliform but prominent ribs usually livid, the intervals hyaline, glossy, charged with 1 row of large, oblong-elliptic, orange glands, the teeth triangular or deltate-cuspidate to triangular-acuminate, ciliate like the adaxial sinus with soft, rufescent hairs, pilosulous within, the ventral pair 0.7–2.4 mm long, the rest commonly a trifle shorter; *petals* 1–3, pale blue to milky white, eglandular, the episteMonous pair, when present, perched near middle of androecium; *banner* 3.8–5.5 mm long, spatulate, the ovate-elliptic or -subcordate, nearly erect blade 2.2–2.8 mm long,

1.4–2.2 mm wide; *inner petals* 1.4–2.2 (2.6) mm long, subsymmetrically oblanceolate, very shortly clawed, not or scarcely auriculate, fugacious; *androecium* 5–10-merous, 4.2–6 mm long, all or only five anthers functional, or some of the alternate ones functional but much smaller, the longer filaments free and blue-tinged for ± 0.8–1.2 mm; *pod* (little known) obliquely obovoid, ± 2.5 mm long, the valves thinly papery or submembranous, gland-sprinkled distally, finally separating along the sutures; *seed* ± 1.5 mm long.

At early anthesis the relatively uncommon *D. urceolata* closely resembles its widespread relative *D. leporina*, differing principally at that stage in its glabrous calyx-tube and in the presence of only one (not two) pair of fugitive little inner petals, which are cast off as the androecium emerges from the bud. Later on the calyx swells up into an ovoid or even subglobose bladder, striped lengthwise by the slender livid ribs and charged on each broad, glossily hyaline interval with a line of large orange blister-glands. In fruit *D. urceolata* is thus easily distinguished both from *D. leporina* and from the also related *D. exserta*, as discussed in greater detail under the foregoing species.

No less than five specific names have been based on forms of *D. urceolata*: in addition to the oldest, *D. inflata* Jones, *Parosela barberi* and *lucida* Rydb., and *Petalostemon tripetalus* Wilson. The differential characters, real or supposed, are found in habit of branching, number of leaflets, presence or absence of the single pair of epistemonous petals, and number of stamens, functional or partly degraded, to the androecium. In the pine forests and adjacent grasslands of Sierra Madre Occidental northward from Durango into central Arizona all known races of *Dalea urceolata* are characterized by a 7–10-merous androecium the number of antheriferous members sometimes varying from 7 to 10 from flower to flower of a single plant. In the Neovolcanic Belt from southern Jalisco to Morelos the stamens are 5–7, always five fully fertile members with an indeterminate number of intervening rudiments, some of which may bear small anthers. From Chihuahua northward in the Sierra Madre, as also in south-central Mexico, there are always, so far as observed, two epistemonous petals, though these are so fugitive that their presence is best determined by dissection of an unopened flower. Locally in Durango the corolla is reduced to banner alone. In northern Sierra Madre leaflets of main cauline leaves tend to be relatively few, most commonly in the range of 5–11 pairs, but up to 14 pairs are seen on specimens (*G. J. Harrison 4895*) from Gila County, Arizona. The same latitude of variation is known from the Neovolcanic Belt in Mexico, where maximum numbers of 9–13 pairs are on record. In both areas the plants differ among themselves in mode of branching, some giving rise from axils closely following the cotyledons to one or several incurved-ascending major branches, often overtopping the primary central axis, others retaining a simple erect stem with the first axillary branch issuing from an axil near or beyond the middle. Independently of these variable features the calyx-teeth may be relatively short or long, when short appearing relatively broad, by reduction of the terminal cusp. Within the species, sensu lato, there seems to be no decisive morphological discontinuity, only three fairly well marked geographic expressions of a variable theme, treated below as three varieties.

Key to the Varieties of *Dalea urceolata*

1. Functional stamens 7–10; central and northern Sierra Madre Occidental.
   2. Corolla 3-petalous, consisting of banner and one pair of fugacious epistemonous petals; s. Chihuahua n. into s.-w. New Mexico and centr. Arizona. 29a. var. *urceolata*.
   2. Corolla 1-petalous, reduced to the banner; Durango. 29b. var. *lucida*.
1. Functional stamens 5–7; Neo-volcanic Belt in s.-centr. Mexico (Michoacán to Morelos). 29c. var. *tripetala*.

29a. Dalea urceolata Greene var. urceolata
(Plate XLIX)

Stems either erect and simple, branched distally, or several from near base of primary axis, then incurved-ascending; *leaflets* (3) 5–14 pairs, usually flat and not thick-textured; *petals* 3; *stamens* 7–10. — Collections: 7 (o).

Xeric pine-forest, 2050–2550 m (± 6800–8500 ft), rare and seldom collected, e. slope of Sierra Madre Occidental in s. and centr. Chihuahua; headwaters of Gila River in s.-w. New Mexico, n.-w. along the Mogollon mountain system to s. Coconino County, Arizona. — Flowering August to October. — *Material*: Arizona. Coconino: Flagstaff, *C. B. Caster* (US); Gila: Hilltop [= Hillcamp] on San Carlos Res., *Harrison 4895* (US). New Mexico. Catron [formerly part of Socorro]: type of *D. urceolata*; Mimbres R. S., *Eggleston 16373* (GH). Chihuahua. Madera: Chuichupa, type of *D. inflata*; *LeSueur 701* (ARIZ, F, OKLA); Hidalgo del Parral: Colonia Garcia, type of *Parosela barberi*.

Dalea urceolata Greene var. **urceolata**. *D. urceolata* (urn-shaped, of the inflated fruiting calyx) Greene, Leafl. Bot. Obs. **1**: 199. 1905. — "Type specimens from the Mogollon Mountains, N. Mex., 20 Aug., 1903, by Mr. Metcalfe...n. 553." — Holotypus, ND! isotypi, BM, F, GH, MEXU, NY (2 sheets), US! — *Parosela urceolata* (Greene) A. Hell., Muhlenbergia **6**: 96. 1910.

Dalea inflata (blown up, of the calyx) Jones, Contrib. West. Bot. **12**: 7. 1908. — "Round Valley and Meadow Valley near Chuichupa, Chihuahua, in the Sierra Madre Mts., 7000 ft...Sept., 1903." — Lectotypus, collected at 7000 ft in Round Valley, 17 Sept 1903, *Jones s. n.*, POM (2 sheets)! paratypus, collected the same day in Meadow Valley, POM!

Parosela barberi (Charles Melvin Barber, 1876–) Rose ex Rydb., N. Amer. Fl. **24**: 74. 1920 ("*Barberi*"). — "Type collected in the Sierra Madre near Colonia Garcia, August 22, 1899, *Townsend & Barber 275.*" — Holotypus, so labelled, US! isotypi, MICH, NY (2 sheets), Z! — *Dalea barberi* (Rose ex Rydb.) Bullock, Kew Bull. **1939**: 194. 1939.

29b. Dalea urceolata Greene var. lucida (Rose) Barneby
(Plate XLIX)

Stems (so far as known) erect, few-branched distally; *leaflets* mostly 9–14 pairs, of thicker texture than those of var. *urceolata* and more glaucous beneath; *petals* 1 (banner); *stamens* 7–9. — Collections: 2 (o).

Xeric pine-forest and open grassland east of the forest belt, 2100–2500 m., rare and local along e. piedmont of Sierra Madre and adjoining plains in centr. Durango. — Flowering September to November. — *Material*: Durango. Durango: typus. Guadalupe Victoria: s.-w. of Ignacio Allende, *Gentry 6911* (MICH, NY).

Dalea urceolata Greene var. **lucida** (Rose ex Rydb.) Barneby, stat. nov., based on *Parosela lucida* (glossy, of the calyx) Rose ex Rydb., N. Amer. Fl. **24**: 74. 1920. — "Type collected at Cajetes [fide McVaugh, 1956, p. 190 = Las Cajetas, an abandoned rancho, on road between Durango and Otinapa], Durango, 1896, *Edward J. Palmer 955...*" — Holotypus, US! — *Dalea lucida* (Rose ex Rydb.) Gentry, Madroño **10**: 250. 1950.

29c. DALEA URCEOLATA Greene var. TRIPETALA (P. G. Wilson) Barneby
(Plate XLIX)

Stems usually erect, but branched either from near base or beyond middle; *leaflets* mostly 6–13 pairs; *petals* 3; *stamens* 5–7, five perfect, the rest variably diminished or reduced to rudiments. — Collections: 9 (iv).

Pine-forest, sometimes with bunch-grasses or on pedregal, descending through the oak-pine belt to its lower edge, 1845–2550 m, locally plentiful on the s. slope of the Neo-Volcanic belt and margins of Balsas Depression from Volcán Colima, Jalisco, e. to s. México and Morelos. — Flowering September to December. — *Material*: JALISCO. Zapoltiltic: n. slope Volcán Colima, *McVaugh 13,564* (MICH). MICHOACÁN. Zitácuaro: Zitácuaro to Los Macheros (type). Anguangueo: Anguangueo, *Paul Duke of Würtemburg in 1830* (M). Uruapan: s. of Carapan, *Ripley & Barneby 14,088* (CAS, DS, GH, MEXU, MICH, NY, US), *14,845* (CAS, DAO, NY). MÉXICO. Otzoloapan: Cerro del Pinal, *Matuda 31,776*, p. p. (mixed with *D. obreniformis*, US). —: Oxtitilpan, between Toluca and Temascaltepec, *W. L. Graham 1271* (MICH, p. p.). MORELOS. Huitzilac: Tres Cumbres, *Ripley & Barneby 14,528* (NY); Cuernavaca: 4 mi n.-e. of Cuernavaca, *Ripley & Barneby 14,539* (CAS, NY, US).

Dalea urceolata Greene var. **tripetala** (P. G. Wilson) Barneby, stat. nov., based on *Petalostemon tripetalus* (3-petalled) P. G. Wilson, Kew Bull. **1958**: 159. 1958. — "Mexico. State of Michoacán: District of Zitácuaro, Zitácuaro to Los Macheros...11 Oct. 1938, *G. B. Hinton 13351*." — Holotypus, K! isotypi, NY, UC, US (mixed with *D. reclinata*), W!

The var. *tripetala* was the first discovered (1830), and the last described (1938), but is now the best known form of *D. urceolata*. The epithet *tripetala*, meaningful in *Petalostemon*, is here only descriptive, not diagnostic, the flower being essentially like that of var. *urceolata* in everything but the reduced androecium. In general the individual plant of var. *tripetala* is more vigorous than the average var. *urceolata*, perhaps due to the higher rainfall and more benign autumn climate of its home. The calyx tends to be a little less distended than that of var. *urceolata*; on this point see further under *D. exserta*.

30. DALEA TRANSIENS Barneby
(Plate L)

Erect, very slender, sparsely leafy annual herbs 1–5.5 dm tall, glabrous to the silky-pilosulous spikes, the stems angular-ribbed, purplish at base, distally green and charged with a few small, scattered glands, branching from near the base or (depauperate) only from above the middle, the foliage bicolored, the leaflets yellow-green above, paler or subglaucescent and punctate beneath; *stipular spurs* 0.4–0.8 mm long, the blades deltate short-acuminate 0.3–1 mm long, livid or castaneous, subglandular, deciduous; *intrapetiolular glands* spiculiform; *post-petiolular glands* small, pale, immersed or lenslike; *leaves* drought-deciduous, (0.8) 1–3 (3.5) cm long, shortly petioled, the narrowly obtuse-margined rachis not or faintly punctate, the 5–11 (13) leaflets distant, linear-oblanceolate or -elliptic, emarginate, thick-textured and loosely involute, (2) 3–8 mm long; *peduncles* filiform, both terminal and leaf-opposed, 1.5–9 (11) cm long; *spikes* moderately dense, oblong to cylindroid, without petals (or pods) 5.5–7 mm diam, the villosulous axis becoming (0.3) 0.5–2 cm long; *bracts* early deciduous, narrowly elliptic- or lance-acuminate, dorsally livid, glandular, pi-

losulous; *calyx* 2.7–3.2 mm long, silky-pilosulous with fine, ascending hairs up to 0.8–1 mm long, the tube 1.5–2 mm long, at anthesis turbinate, ± 1.5 mm wide at orifice, in fruit broader, campanulate, the dorsal sinus recessed, the ribs subfiliform, livid, the flat membranous intervals charged with 1 row of ± 3 small yellowish or brownish glands, the narrowly triangular short-acuminate livid gland-spurred teeth 1–1.4 mm long; *petals* bicolored, the banner cream and pink, the inner ones pink-lilac, perched near middle of androecium, the keel-petals free even in vernation; *banner* 2.4–3 mm long, the claw 1.3–1.8 mm, the deltate-cordate, subacute blade (0.8) 1.2–1.5 mm long, (1) 1.2–1.6 mm wide; *wings* 1.6–2.5 mm long, the claw 0.4–0.7 mm, the obliquely lance-ovate blades 1–1.5 mm long, 0.5–0.8 mm wide; *keel-petals* a trifle longer or shorter than the wings, the claw 0.8–0.9 mm, the obliquely ovate, obscurely auriculate blade 1.1–1.4 mm long, 0.7–0.8 mm wide; *androecium* 5-7-merous, 2.7–3 mm long, at least 5 and often all stamens fertile, the longer filaments free for ± 0.7 mm, the connective minutely gland-tipped, the pallid anthers 0.25–0.3 mm long; *pod* exserted from the calyx-tube, 2.4–2.8 mm long, hyaline at base, pilosulous distally; *seed* green-ochraceous, 1.7–2 mm long. — Collections: 3 (ii).

Shallow soil of depressions on flat-topped mesas or on open stony hillsides among grasses, 1920–2130 m, local but inconspicuous and possibly overlooked, known only from the e. piedmont of Sierra Madre Occidental, along and near the line of oak-woodland transitional to grassland, in central Durango. — Flowering September to November. — *Material*: DURANGO. Durango: "Durango and vicinity", *Palmer 795* in 1896 (UC); 10 mi. s.-w. of Ciudad Durango (type). Canatlán: Donato Guerra, ± 41 mi n. of Ciudad Durango, *Ripley & Barneby 13,958* (CAS, NY, US).

Dalea transiens (transient, of short duration) Barneby, sp. nov., a *D. leporina* caulibus filiformibus, foliolis 2–5 (6)-jugis, necnon floribus minutis (vexillo 2.4–3 mm tantum longo) facile separanda. A *D. filiformi*, habitu comparanda, foliis pinnatis nec 3-foliolatis foliolis linearibus sed haud vero filiformibus, carinaeque petalis ab initio inter se liberis, a *D. polygonoide* bracteis cito delapsis calycisque forma ac glandulis minutis longius ut videtur abstat. — MEXICO. DURANGO: shallow soil of depressions on top of mesa, 2130 m (± 7100 ft), in the first benches of Sierra Madre ± 10 mi (15 km) s.-w. of Ciudad Durango, nov 9, 1963, *Ripley & Barneby 13,481*. — Holotypus, NY! isotypi, CAS, GH, K, MICH, US!

A delicate annual herb with threadlike but wiry stems and narrow spikes of minute flowers, always inconspicuous but becoming especially well camouflaged in late summer, when the leaves have mostly fallen. In habit *D. transiens* suggests *D. filiformis*, but differs in its pinnate, not quinque- or palmately trifoliolate foliage, in its proportionately wider because shorter leaflets, and in the free epistemonous petals, of which the inner pair never forms an united sheath around the anthers. From the coarse and common *D. leporina*, which has the same free keel-petals, it differs more directly in its frail stature, few leaflets, and few-flowered spikes of smaller flowers; and from the less similar *D. polygonoides* in (inter alia) the deciduous interfloral bracts and small calycine glands. To be sought elsewhere along the east foothills of Sierra Madre.

IIIC. Sectio KUHNISTERA (Lamarck) Barneby

Perennial herbs, some precociously flowering the first season but none truly monocarpic, a few weakly suffrutescent in age; *epistemonous petals* all free, perched near (rarely above) middle of androecium at or immediately below separation of filaments; *androecium* 5 (exceptionally 6)-merous, the free filaments as long or longer than

the column, exceptionally (*D. obovata*) shorter. — Spp. 22, widely dispersed over United States e. of the Sierra-Cascade axis, s. and w. of the hardwood forest regions, 2 n. on prairies to s. Canada, 2 weakly s. into n. Mexico.

Dalea subgen. **Dalea** sect. **Kuhnistera** (Lamarck) Barneby, comb. nov., based on *Kuhnistera* (derivative of *Kuhnia*, a genus of *Asteraceae*) Lamk., Encycl. Méth. **3**: 370. 1792. — Generitypus: *K. caroliniensis* Lamk. = **Dalea pinnata** (G. F. Gmelin) Barneby. — *Petalostemum* sect. *Kuhnistera* (Lamk.) DeCandolle, Prod. **2**: 243. 1825, comb. illegit., but retroactively legitimized by conservation of posterior *Petalostemum* against *Kuhnistera*. — See further under ser. *Kuhnistera*, infra.

Dalea Jussieu, Gen. 355. 1789, quoad descr. Non *Dalea* Luc., 1758.

Dalea *Pentandrae (apparently descriptive, not nomenclatural) Spreng., Syst. Veg. **3**: 326. 1826.

Cf. further synonymy under ser. *Candidae*.

Under the unfamiliar but historic title of sect. *Kuhnistera* I begin to describe that complex group of perennial herbaceous daleas which have been known latterly as genus *Petalostemum*, and as such recently studied and most capably monographed by D. K. Wemple (1970). Unlike the majority of *Dalea* and *Marina* species, which are Mexican and Andean, the petalostemons or prairie-clovers are almost endemic to continental United States, where they have been intensively collected for a century or more. The herbarium record is now extensive, and a concensus reached as to the number, but not the rank, of usefully distinguishable entities in the group. Wemple's revision, based on morphological, palynological, and general biosystematic studies, reinforced by experience in the field of all but a few rare or exclusively western species, will remain the basic text, containing much information which cannot be repeated in this context. The distribution maps, based in part on herbaria that I myself have not consulted, have been especially helpful. However, in formulating statements of dispersal I have made a point of verifying in almost all cases the peripheral records.

A second report on the same group of plants within so short a time must appear superfluous, and would be so but for one circumstance. In the early stages of my study of Amorpheae I became convinced that *Petalostemum* (as already suggested, but without substantial documentation, by Shinners) represents a phylogenetic branch of *Dalea* no more distinct, even though more numerous in sorts, than several others that, for a variety of historical and geographical reasons, have never received comparable attention. A major objective of this account is to place these evolutionary branches in some sort of perspective, and the omission of *Petalostemum* would defeat this aim. My reasons for including *Petalostemum* within *Dalea* sens. lat. have been given in my redefinition of the latter genus. I would suggest that the sceptic review reflectively the figures of *D. cliffortiana* (Pl. XLII), generitype of *Dalea, D. albiflora* (Pl. XXXV), generitype of *Thornbera, D. emarginata* (Pl. XLVI), described originally as *Petalostemum* but excluded by Wemple, and *D. obovata* (Pl. LI), by the same standards a good *Petalostemum*, and contrast these types collectively with the series (Pl. LXII to end) here called subgen. *Parosela*. It will be seen that within subgen. *Dalea* the pentandrous flower of *Petalostemum* has no single feature unique to itself, and the general aspect of 5-, 7-, 9-, and 10-androus species is astonishingly repetitive. The excision from subgen. *Dalea* of sect. *Kuhnistera* at the rank of genus would open the door to an irrational generic segregation of all equivalently characterized species-groups and even individual species.

Once the decision to describe and illustrate sect. *Kuhnistera* had been made, I was confronted with a dilemma: whether to follow Wemple in the definition of the species, thereby adopting a more critical policy than obtains in other sections of the genus; or to interpret the data independently and impose a more uniform taxonomic standard. Because the nomenclature, following the shift of *Petalostemum* to *Dalea*, must in any case be different,

it seemed less objectionable to adopt the second course. Disregarding the newly described *D. bartoni*, the number of taxa remains unchanged; but reduction in rank of several reduces the number of major species from Wemple's twenty-nine to twenty-two. The shift in values is reflected further in my definition of supraspecific groups. Wemple recognized two subgenera, *Kuhnistera* and *Petalostemon* [sic], and within the latter, following with slight deviations the monograph in *North American Flora* (Rydberg, 1920), eight species-groups of unspecified rank. These are consolidated herein into five formally described series.

Another departure will be noted in the order of presentation. The section *Kuhnistera* as a whole is highly modified and specialized; the species do not fall into obvious phylogenetic sequences, and a linear order can be at best rational. The monotypic Texan *Agastachyae* is placed first so as to emphasize its technical intermediacy between sect. *Kuhnistera* and sect. *Dalea*, of which it has the short filament-tassel and autogamous flower. The western *Compactae*, with characteristic foliage of large expanded leaflets but poorly developed axillary short-shoots, follow *Agastachyae*, linked by *D. cylindriceps*, which has the massive spike of tiny flowers of *D.* (*Agastachyae*) *obovata* combined with the long tassel of typical *Kuhnistera*. From *D.* (*Compactae*) *searlsiae* an easy path leads to *D.* (*Candidae*) *scariosa*, the latter not central to its group but firmly linked to it through *D. bartoni, D. sabinalis*, and *D. foliosa*. The *Candidae*, the most widely dispersed series of sect. *Kuhnistera*, characterized by developed bracteoles and a calyx nearly always glabrous externally, lead nowhere; they seem to represent a phylogenetic dead end, and I return to ser. *Compactae* for a starting point for ser. *Purpureae*. The calyces of *D.* (*Compactae*) *ornata* and *D.* (*Purpureae*) *tenuifolia* are suggestively similar; the two series are artificially separated by characters of foliage, but are also separable in terms of ecology and dispersal. The range of ser. *Purpureae* lies entirely east of the Continental Divide; it is thus contained within that of ser. *Candidae* but is less extensive, no species occurring either on the Coastal plains of s.-e. United States or to the west and south of the Rio Grande valley. In the range common to ser. *Candidae* and ser. *Purpureae* one species of each may often be found in a shared habitat. This is exemplified strikingly by the coexistence of endemic (or nearly endemic) species in the Tennessee cedar-glades and on the limestones of Edwards Plateau in Texas. It seems probably that ser. *Candidae* and ser. *Purpureae* represent coordinate and parallel branches which diverged long ago but have developed in parallel fashion under the same selective pressures. Last in order is the monotypic, morphologically isolated ser. *Kuhnistera*. While highly idiosyncratic in appearance, *D. pinnata* lacks characters unique in the wider context of sect. *Dalea*. An involucre of sterile bracts appears independently in the annual *D. emarginata* and the calyx-teeth are hardly longer or more aristiform than those of *D.* (*Agastachyae*) *obovata*; the foliage resembles that of sympatric *D.* (*Candidae*) *feayi* but coincides with silky-pubescent calyces.

References to past literature of genus *Petalostemum* raise vexatious problems in spelling. The genus was published as *Petalostemum* (neuter). Rydberg (1920, p. 121, nota) adopted the linguistically preferable *Petalostemon* (masculine). The genus has since been conserved (against *Kuhnistera*) as *Petalostemon*, but irrationally restored to neuter gender. Wemple (1970) follows the Code in this matter, but quaintly preserves the masculine ending for adjectival plurals such as *Carnei, Scariosi*. For purposes of citation I have followed the form and gender adopted by the quoted author, even though this sometimes involves two spellings in the same paragraph.

Key to the Series of Sect. *Kuhnistera*

1. Spikes short, appearing capitate, and subtended by an involucre composed of 2–3 ranks of papery castaneous bracts and bractlike leaf-bases, the inner rank broadly ovate and up to 4–5.5 mm long, 3.5–4 mm wide; *calyx-teeth* linear,

aristiform or becoming so, 1–2 times as long as tube, plumose; s.-e. United States (North Carolina to Mississippi and s. Florida.
IIIC (v). Ser. *Kuhnistera* (p. 276)

1. Spikes either short or long, but if at all involucrate the bracts smaller, and the calyx-teeth shorter than tube, in the range of *D. pinnata* much shorter.
   2. Bracts of the spike subtended by persistent, linear or spiculiform, usually puberulent bracteoles, these mostly up to 0.5–1.6 mm, rarely only 0.2–0.5 mm long; *calyx* commonly glabrous externally, but if puberulent (as sometimes in *D. phleoides* and *D. candida* var. *oligophylla*) the petals white.
   IIIC (iii). Ser. *Candidae* (p. 234)
   2. Bracts of the spike not bracteolate, the bracteoles either obsolete or represented by sessile glands; *calyx* usually densely pilose externally from base upward, always so if the petals white, sometimes glabrate in purple-flowered *D. searlsiae* or tomentulose in lines below the sinuses in *D. compacta* and forms of *D. purpurea*.
      3. Leaflets (3–5 pairs) amply obovate (some 1–1.5 cm long) and densely pilose both sides, not obviously punctate beneath; *spikes* at once very dense and very massive, without petals 14–20 mm diam; *tassel* of free filaments shorter than column; Coastal Plain in s. Texas.
      IIIC (i). Ser. *Agastachyae* (p. 223)
      3. Leaflets either narrower or glabrescent or more numerous, nearly always conspicuously punctate beneath; *spikes* without petals usually much narrower, if up to 16 mm diam the foliage glabrous and range otherwise; *tassel* of free filaments as long or longer than column.
         4. Leaflets (2–4 pairs) of relatively broad type, obovate to oblanceolate; *stems* moderately leafy, most primary cauline leaves not subtending developed leafy short-shoots or leaf-fascicles; *spikes* usually long-pedunculate, raised above the foliage; species of Intermountain United States (s.-e. California to interior Washington, s.-e. Utah, n. Arizona) and one (*D. cylindriceps*) on the high plains e. of Continental Divide (s.-w. North Dakota to w. Texas and Rio Grande valley in New Mexico), this with massive spikes of small, usually whitish flowers, without petals 9–12 mm diam. IIIC (ii). Ser. *Compactae* (p. 225)
         4. Leaflets of narrow type, linear to linear-oblanceolate or -elliptic; *stems* densely leafy, nearly all primary cauline leaves subtending leafy short-shoots or fascicles of smaller leaves; *spikes* often subsessile, if pedunculate the petals purple; widespread e. of Continental Divide, but those sympatric with *D. cylindriceps* differing in much narrower spikes and showy pink-purple flowers. IIIC (iv). Ser. *Purpureae* (p. 227)

IIIC (i). Series AGASTACHYAE Barneby

Potentially perennial herbs of short duration, silky-villous throughout with fine weak silky hairs; *leaflets* 3–5 pairs, amply obovate, not or obscurely punctate beneath; *spikes* subsessile, very dense and massive, without petals 14–20 mm diam; *calyx-teeth* triangular-aristate, the tips linear-subulate; *free filaments* shorter than the androecial column, as long as the style, the flower self-pollinating. — Sp. 1, of the Gulf Coastal Plain in Texas.

Dalea sect. **Kuhnistera** ser. **Agastachyae** Barneby, ser. nov., a ser. *Compactis* imprimis calyce aristato-dentato filamentisque liberis abbreviatis, hac nota inter sect. *Daleam* et sect. *Kuhnisteram* quasi intermedia, ab aliis *Kuhnisteris* veris pube lanuginosa densa foliolisque expansis valde distincta. — Sp. unica: *D. obovata* (T. & G.) Shinners.

The one species of ser. *Agastachyae* was referred by Rydberg (1920, p. 122) to his *Petalostemon* V. *Compacti*, and retained in a modified group of the same name by Wemple (1970, p. 61, sequ.). Its resemblance in the massive cylindric spike of minute, fleeting flowers to *D. cylindriceps* (cf. Pl. LI) suggested this alignment, and it can hardly be doubted that the two species are indeed kindred. As Wemple points out, the flower of *D. obovata* is unlike that of any other *Petalostemum* (= sect. *Kuhnistera* of this account) in its short filament-tassel, of the same length as the mature style, which ensures self-fertilization of the flower. In this respect it is like several members of sect. *Dalea*, except that the tassel is reduced to five filaments. Other dalea-like features of *D. obovata* are the aristate calyx-teeth and short-lived root, not truly annual, but not soundly perennial either, as in typical *Petalostemum*. These peculiarities, combined with the strong individuality of the plant, due to its dense silky vesture, broad leaflets, and immense sessile spikes, entitle *D. obovata* to a monotypic series.

31. Dalea obovata (Torrey & Gray) Shinners
(Plate LI)

Coarsely leafy herbs, from potentially perennial but short-lived orange roots, sometimes flowering the first season, up to 5.5 dm tall, densely lanate-pilose throughout with fine lustrous spreading and ascending spiral hairs up to 1.2–2.2 mm long, the stout, remotely micro-glandular stems erect and incurved-ascending, simple or few-branched either from below the middle or distally, densely leafy almost up to the massive cylindric spikes (but primary cauline leaves drought-deciduous), the foliage gray (the vesture rusty when dried), the leaflets under the hairs green above, not punctate beneath; *leaf-spurs* up to 1.8 mm long; *stipules* narrowly lance-acuminate or -caudate, thinly herbaceous or submembranous, pallid or castaneous, 3–8 mm long, plumose; *intrapetiolular glands* 0; *post-petiolular glands* small but prominent; *leaves* shortly petioled, the primary cauline ones (2) 2.5–5 cm long, with remotely micro-punctate, narrowly wing-margined rachis and 3–5, commonly 4 pairs of obovate, obtuse or abruptly short-acuminate (sometimes penicillate-acute), flat leaflets up to (0.8) 1–1.6 cm long, the stalked terminal one not or little larger than the last pair, the leaves of axillary spurs similar but smaller, with only 2–3 pairs of shorter leaflets; *peduncles* stout, continuous with the stem, 0–3 cm long; *spikes* very dense, the many-ranked flowers contiguous, the whole ovoid in bud quickly becoming ovoid-oblong and then cylindroid, without petals (1.2) 1.4–2 cm diam, the axis 3.5–11 cm long; *bracts* deciduous but the interfloral ones held fast until fall of the fruit, 5.5–11 mm long, subdimorphic, the lowest ovate- to broadly lance-acuminate from cuneate base, not forming a calyculus, the rest very broadly to narrowly spatulate-acuminate, the narrowed, membranous-margined stalk-like base folded to clasp base of calyx, the flat or shallowly concave blade 1.8–5 mm wide, papery or becoming so, commonly castaneous or castaneous-tipped, dorsally pilose-barbate and charged with few small livid glands, plumose-ciliate, glabrous within, the triangular to acuminate tail shorter than blade, pilosulous to tip; *calyx* 3.3–5.8 mm long, densely pilose from very base with straight, ascending and spreading hairs up to 1–2.4 mm long, the rather broadly campanulate tube (1.3) 1.4–2 (2.1) mm long, ± recessed behind banner but the orifice little oblique, the castaneous or pallid ribs filiform, the broad hyaline intervals flat, glandless or charged with 1–2 minute pale glands, the teeth broadly to narrowly triangular-aristate, 2–4 mm long, subhomomorphic but the ventral pair a trifle broadest, the tips all subincurved, castaneous, plumose; *petals* whitish, drying ochroleucous, the epistemonous ones deciduous on expansion from sockets at or just below separa-

tion of filaments; *banner* (3.5) 4–7 mm long, the filiform claw (1.5) 1.9–3.4 mm, the ovate-oblong or oblong, erect, glandless blade (2) 2.2–2.9 (3.1) mm long, 1.2–2 mm wide; *epistemonous petals* 2.5–4 mm long, the narrowly oblong-oblanceolate blades ± 2–3.2 mm long, 0.5–0.9 mm wide, truncately or cuneately narrowed at base into a claw 0.4–0.7 mm long; *androecium* (4.5) 5–6.6 mm long, the column 3–4.4 mm, the free filaments only ± ½–⅓ as long, up to 1.6–2.5 mm long, the connective gland-tipped, the pallid anthers 0.6–0.75 mm long; *pod* obliquely obovate in profile, 2.7–3 mm long, the style-base lateral, the prow slenderly ribbed, the valves thinly papery, glabrous but opaque at base, pilosulous distally; *seed* pale, lustrous, ± 1.7 mm long; 2n = 14 (Mosquin). — Collections: 18 (ii).

Deep sandy and silty soils of the Gulf Coastal Plain in s. Texas, sometimes accompanied by *D. emarginata, D. phleoides,* and *D. lanata*, locally plentiful around the Gulf itself from the mouth of Rio Grande to the inner arms of Matagorda Bay in Jackson County, n. on the Brazos River to Austin and Brazos counties, w. to the foot of Balcones Escarpment in Wilson and Medina counties, and (cf. Wemple, 1970, map 11) to an isolated station on the Rio Grande in s. Valverde County; to be expected in n.-e. Coahuila. — Flowering April to July, sometimes again in fall and early winter. — *Representative*: *Lindheimer 40* (NY, UC, W); *Wemple 724* (NY); *Palmer 230* (NY, US); *Lundell 8851* (TEX); *Ripley & Barneby 14,786* (DAO, NY); *McCart 8325* (OKLA).

Dalea obovata (Torrey & Gray) Shinners, Field & Lab. **17**: 84. 1949, based on *Petalostemon obovatum* (obovate, of the leaflets) T. & G., Fl. N. Amer. **1**: 310. 1838. — "Texas, *Drummond*." — Holotypus, *Drummond 128* of Coll. II, NY (herb. Torr.)! probable isotypus, labelled "between Brazoria and San Felipe", *Drummond 128* of Coll. III, K! — *Kuhnistera obovata* (T. & G.) A. Hell., Bull. Torrey Club **23**: 122. 1896.

Dalea agastachya (great-spiked) Moricand, Pl. Nouv. Amér. 65, tab. XLIV. 1839 — "*Hab. in Texas. Berlandier. No. 2002.*" — Holotypus, 2 sheets, one dated 1829, the other 1832, G! isotypi, some from "between Nueces and Medina rivers", K, NY, P, W! — *Kuhniastera obovata* (Moric.) O. Kze., Rev. Gen. 192. 1891.

An unmistakable dalea, different from any in or near its range of dispersal in the long shaggy pubescence, the few ample leaflets, and the immense subsessile spikes of tiny fleeting flowers, the whitish ribbons of the epistemonous petals being thrown off almost as soon as they expand.

IIIC (ii). Series Compactae (Rydberg) Barneby

Strongly perennial, either glabrous or pilosulous below the spikes; *leaflets* 2–4 pairs, relatively large, obovate to oblanceolate, of thick texture; *spikes* mostly long-pedunculate, very dense or (*D. searlsiae*) loose in age; *calyx-tube* densely long-villous (exceptionally only puberulent or glabrate), either symmetrical at orifice or recessed behind banner, the teeth ovate-triangular; *petals* white or pink-purple. — Spp. 4, of intermountain United States and, e. of continental divide, on the higher plains and upper Rio Grande valley.

Dalea sect. **Kuhnistera** ser. **Compactae** (Rydberg) Barneby, stat. nov., based on *Petalostemon* VII. *Compacti* Rydb., N. Amer. Fl. **24**: 121, 122, in clave. 1920, emend. Wemple, Iowa State Jour. Sci **45** (1): 61. 1970 (exclus. *P. obovato*). — Sp. lectotypica: *Petalostemon compactus* sensu Rydb., Wemple, et auct. recentior. = **Dalea cylindriceps** Barneby.

Petalostemon XI. *Ornati* Rydberg, N. Amer. Fl. **24**: 121, 123, in clave. 1920, pro max. parte. – Sp. lectotypica: *P. ornatus* Dougl. = **Dalea ornata** (Dougl.) Eat. & Wr.

My concept of ser. *Compactae* coincides with Wemple's homonymous group of *Petalostemon*, except that I have removed *D. obovata* to a monotypic ser. *Agastachyae* discussed under that heading above. Rydberg had arranged the species into two groups by means of petal-color, but this was certainly an artificial division, separating closely related entities. Moreover the petals of *D. cylindriceps* may be either white or pink. Wemple has pointed out in his revision of *Petalostemon* that the *Compactae* collectively form a chain of interlocking pairs, *D. ornata* and *D. cylindriceps* being alike in the dense spike of membranous subsymmetrical calyces, whereas *D. searlsiae* and *flavescens* diverge together in their firmer, asymmetric calyces, but forming a dense cone only in the latter. Meanwhile, one of each pair has pink-purple, the other normally white petals. All have broad leaflets of thick texture, abortive or small and inconspicuous axillary short-shoots, and spikes raised well above the foliage on stout long peduncles. All are adapted to cold winters and habitats of the steppe-desert type.

Key to the Species of Ser. *Compactae*

1. Flowers very small, the epistemonous petals (whitish, rarely pale pink) 0.3–0.8 mm wide; *orifice* of calyx subsymmetrical, not deeply recessed behind banner; *leaflets* mostly acute or acuminate; *plant* glabrous up to the dense, massive, conelike spike; *range* on the e. continental slope, from s.-w. North Dakota to w. Texas, w. in New Mexico to the Rio Grande valley. 32. *D. cylindriceps*

1. Flowers larger, the epistemonous petals at least 0.9 mm wide, if white or less than 1 mm wide (or both) the leaflets both obtuse and pilosulous or orifice of calyx recessed behind banner; *leaflets* always obtuse or emarginate; *range* w. of Continental Divide, from n. Arizona and s.-e. Utah to Washington.
   2. Petals white (fading ochroleucous); *foliage* commonly pilosulous (exceptionally glabrous); *calyx-tube* deeply recessed behind banner; *spikes* permanently dense and conelike, the calyces concealing axis of spike; s.-e. Utah and adjoining Arizona. 34. *D. flavescens*
   2. Petals pink-purple (except rare albinos); *foliage* commonly glabrous (pilosulous only in Nevada); *calyx-tube* recessed or not behind banner, but if so the spike becoming loose, its axis not fully concealed by calyces; s.-w. Utah and adjoining Arizona w. and n.-ward, where approaching *D. flavescens* the foliage always glabrous, the spike always loose, and petals always purple.
      3. Spikes dense and conelike, without petals ± 13–16 mm diam, the axis permanently concealed by crowded calyces; *orifice* of calyx-tube scarcely oblique, not or little recessed behind banner; lowlands of Columbia and Snake river valleys in interior Washington and s. Idaho, s. through lake basins of interior Oregon to n.-w. Nevada; *calyx* almost always densely pilose. 33. *D. ornata*
      3. Spikes becoming loose and narrow, without petals ± 8–11 mm diam, the axis partly revealed between the calyces; *orifice* of calyx-tube strongly oblique, deeply recessed behind banner; Great Basin, in e., centr. and s. Nevada, to adjoining California, n.-w. Arizona, and s.-w. Utah, there entering the Colorado Plateau; *calyx* often glabrescent externally. 35. *D. searlsiae*

32. DALEA CYLINDRICEPS Barneby

(Plate LI)

Perennial from an orange taproot but not of long duration and often flowering the first season, (2) 3–6 (8) dm tall, glabrous to the spikes, the (1) 3–several stems stout, simple and monocephalous or corymbosely few-branched from near middle, in the lower half or third leafy and spurred at most nodes, the pallid or stramineous branches prominently striate-ribbed and distally microtuberculate, the thick-textured foliage bicolored, the leaflets green (when dried often verdigris) above, pallid-glaucescent and sparsely punctate beneath; *leaf-spurs* 0.5–1.2 mm long; *stipules* narrowly subulate or linear-lanceolate, 1–2.5 cm long, livid-castaneous and subglandular, becoming dry and fragile; *intrapetiolular glands* 2, minute; *post-petiolular glands* prominent, obtuse; *leaves* short-petiolate, the primary cauline ones 3–7 cm long, with 3–4 pairs of oblanceolate or oblong-elliptic, mostly acute or acuminate, sometimes obtuse and mucronulate, flat or loosely folded leaflets up to (1.2) 1.5–2.5 cm long, the terminal one stalked, longer than last pair, the spur-leaves similar but smaller; *peduncles* (0.3) 0.6–2 dm long; *spikes* very dense, conelike, when pressed 9–12 mm diam and presenting on each side 6–8 ranks of closely contiguous calyces, the pilose axis becoming (1.5) 2.5–16 cm long; *bracts* deciduous only with the disjointing fruiting calyx, 4–6.5 mm long, subdimorphic, the lowest lanceolate to narrowly ovate-acuminate, glabrous dorsally, the interfloral ones narrowly lance-acuminate or -caudate, strongly incurved, submembranous and folded at the narrowed base, distally shallow-concave, herbaceous (becoming papery), castaneous or livid, dorsally densely pilose except for the often glabrescent or glabrous tip; *calyx* 3.4–4.3 mm long, densely pilose externally with straight, ascending hairs up to 1.6–2.4 mm long, the rather broadly campanulate tube 1.9–2.3 mm long, the dorsal sinus a little recessed but the orifice not much oblique, the castaneous ribs little raised, the nearly flat intervals hyaline, charged with 1 (sometimes irregular) row of 2–5 small pale glands, the teeth of subequal length, 1.5–2.2 (2.6) mm long (0.3 mm longer to 0.5 mm shorter than tube), the dorsal one lanceolate, the ventral pair deltate-ovate; *petals* whitish or pink, glandless, the epistemonous ones shed on expansion; *banner* 4.7–6.2 mm long, the claw 2.8–3.8 mm, the deltate- or ovate-cordate, distally hooded, entire or emarginate blade 1.4–2.7 mm long, 1.6–2.1 mm wide; *epistemonous petals* isomorphic, 2.1–4.7 mm long, narrowly oblong-oblanceolate, 0.3–0.8 mm wide, narrowed downward into and ± twice as long as the short claw; *androecium* 5.3–7.7 mm long, the column 2.5–3.4 mm, the free filaments 2.2–4.3 mm long, the anthers ± 0.7–0.9 mm long; *pod* in profile obliquely obovate, 2.5–3 mm long, strongly incurved, the ventral suture shortest, the dorsal suture becoming greatly thickened and castaneous along the prow, the ascending style-base lateral, the valves hyaline in lower ⅔, thence thinly herbaceous, gland-sprinkled, pilosulous; *seed* castaneous, 1.7–2.1 mm long, nearly as wide. — Collections: 17 (i).

Dunes, sandy prairies, and sand- or gravel-banks along rivers or intermittent streams, 900–1600 m (± 3000–5300 ft), widely but discontinuously dispersed over the high prairies between s.-w. South Dakota and w. Texas (upper Cheyenne R. in S. Dakota; forks of Platte R. from w. Nebraska upstream just into Wyoming and in Colorado to Denver; Cimarron River in extreme s.-e. Colorado, adjoining Kansas, and Oklahoma panhandle; headwaters of Canadian R. in n.-e. New Mexico and of Concho R. in w. Texas); disjunctly in scattered stations along the Rio Grande in n.-

centr. and s. New Mexico; cf. Wemple, 1970, map 11, as *P. compactum*). — Flowering late May to September. — *Representative*: SOUTH DAKOTA: *Heyward 539* (NY). NEBRASKA: *Steve Stephens 16,154* (NY); COLORADO: *Eastwood 34* (UC); *Tracy 900* (NY); *Weber 5169* (UC). KANSAS: *Hulbert 3232* (WIS); *C. H. Thompson 26* (NY). OKLAHOMA: *Engleman in 1957* (OKLA, UC, WIS). NEW MEXICO: *Ripley & Barneby 8347* (NY); *Higgins 5726* (NY). TEXAS: *Tharp 5969* (US).

Dalea cylindriceps (of the massive spike) Barneby, nom. nov., a substitute for *Petalostemum macrostachyum* (large-spiked) Torr., Ann. Lyc. N. Y. **2**: 176. 1827. — "About the Forks of the Platte..." — Holotypus, collected by Dr. Edwin James on Maj. Long's First Expedition, NY (herb. Torr.)! — Non *Dalea macrostachya* Moric., 1833.

Petalostemon compactus sensu Swezey, Neb. Fl. Pl. (Doane Coll. Nat. Hist. Soc. 1:) 6. 1891, et auct. plur. recentior.; Wemple, Iowa State Jour. Sci. **45** (1): 68. 1970. — Non *Dalea compacta* Spreng., 1826.

The adoption for *P. macrostachyum* Torr. of the epithet *compactum*, in use during most of the present century, dates back to Swezey's transfer of *Dalea compacta* Spreng. in 1891. The transfer was no doubt suggested by the fact that Torrey & Gray (1840, p. 691) had long before cited *D. compacta*, which they were unable to interpret with any confidence, as a possible synonym of *P. macrostachyum*. The type-locality of *D. compacta*, given in the protologue as Red River, Arkansas, is in all probability the present Choctaw County, Oklahoma, but this was not known to Swezey who presents no evidence of having learned any more about *D. compacta* than was known to Torrey & Gray. As the dispersal of the species in question became better known, Rydberg (1920, p. 128) provisionally reinterpreted the Rio Roxo of Sprengel (Nuttall's Red River) as the Canadian, inferentially moving the type-locality from the southeastern corner of Oklahoma to its far western extremity in the Panhandle, where *P. macrostachyum* is known actually at this day only from the Cimarron, not the nearby Canadian valley. In any case there is no reason whatever to suppose that any botanist could have sent *P. macrostachyum* to Sprengel from what is now western Oklahoma before the year 1826, and still less to suppose that a plant from that region would have been so mislabelled. Assuming that *Dalea compacta* is in reality the same as *Petalostemum decumbens* Nutt., it becomes necessary to restore *Petalostemum macrostachyum* Torr. The unwelcome new epithet *cylindriceps* is a nomenclatural necessity following reduction of genus *Petalostemum* to *Dalea*.

Nuttall's itinerary en route to Red River in 1819 is described in detail by Geiser, Field & Lab. **24**: 43–60. 1956.

33. DALEA ORNATA (Douglas) Eaton & Wright
(Plate LII)

Coarsely leafy perennial herb from a tough brown root and short caudex, (2) 2.5–5 dm tall, glabrous to the inflorescence, the several stout, erect or decumbent-incurved, pale green or stramineous, prominently ribbed, microtuberculate stems either simple except for axillary spurs or paniculately branched from (near) above middle, the foliage bicolored, the thick-textured leaflets yellowish (when dry sometimes verdigris) green above, pallid-glaucescent and livid-punctate beneath; *leaf-spurs* almost 0 to 1 mm long; *stipules* subulate, 0.5–2.5 mm long, early papery and fragile, greenish-stramineous externally, livid-glandular within; *intrapetiolular glands* minute; *post-petiolular glands* prominent, obtuse; *leaves* petioled, the primary cauline ones 2.5–5.5 (6.5) cm long, with narrowly thick-margined rachis and 5–7 (9) broadly oblanceolate or elliptic-oblanceolate to broadly obovate, obtuse, sometimes gland-

mucronate, or emarginate, flat or loosely folded leaflets up to 7–22 mm long, the stalked terminal leaflet always largest, the leaves of axillary spurs similar but smaller; *peduncles* 1–11 cm long; *spikes* very dense, ovoid becoming oblong-cylindroid, or the smaller lateral ones subglobose, without petals 13–16 mm diam, the calyces (pressed) appearing ± 5–8-ranked on each side, the densely pilose to glabrescent or truly glabrous axis (1) 1.5–5 (6) cm long; *bracts* organically deciduous at anthesis, but held fast between the calyces and falling with them, (3) 4–7.5 (8.5) mm long, subdimorphic, the lowest lanceolate, firm from base, the interfloral ones proximally narrowed downward, folded, and membranous, thence lanceolate, livid, dorsally pilose, tapering into a subulate or setaceous tip; *calyx* (3.6) 3.9–6.3 (6.7) mm long, pilose from base upward or sometimes only on the teeth with fine straight spreading-ascending, lustrous hairs up to (0.8) 1–2 (2.2) mm long, the broadly top-shaped tube (2.4) 2.7–3.6 (3.8) mm long, not or scarcely recessed behind banner, the ribs filiform, not or scarcely prominent, the membranous pallid intervals charged with 2–9 small, transparent or yellow blister-glands, the teeth of about equal length (but either dorsal or ventral sometimes longest), up to (1) 1.2–2.9 mm long, not greatly dissimilar in shape, the 3 dorsal ones ovate, triangular, or lanceolate, the ventral pair deltate to ovate-lanceolate, their plane tips green or livid; *petals* rose-purple or pale lilac, exceptionally white, glandless; *banner* 7–9 mm long, the claw 3.9–5 mm, the ovate or ovate-oblong, emarginate blade broadly cuneate to truncate, rarely subcordate at base, 3.3–4.5 mm long, (2) 2.3–4 mm wide; *epistemonous petals* 4.5–6.6 mm long, oblong-oblanceolate, the claw 1.3–1.8 (2) mm, the blades (3.3) 3.5–5 mm long, 1.4–2 mm wide; *androecium* (7.3) 7.7–12 mm long, the column 2.6–5 mm, the pinkish free filaments up to (3.6) 4.7–7.6 mm, the anthers yellow 1–1.4 mm long; *pod* 3–3.5 mm long, obliquely compressed-obovoid, the ventral suture slightly concave, the dorsal strongly convex, the style-base latero-terminal, the prow slenderly carinate, the valves glabrous and hyaline in lower ⅓–⅔, distally thin-papery, pilosulous, finely gland-sprinkled; *seed* 2–2.4 mm long; n = 7 (Spellenberg, Taxon **20**: 355). — Collections: 38 (iii).

Sandy and shaley barrens, rocky ridges, gullied bluffs and knolls, often among sagebrush, of local and discontinuous dispersal in the Snake-Columbia basin w. of the Cascades, and n.-w. Great Basin: at 100–1260 m (± 350–4200 ft) along Snake River and immediate affluents in s.-w. Idaho (Elmore and Owyhee County, downstream to Weiser) and adjoining Oregon, reappearing near the mouth of Clearwater River in extreme s.-e. Washington, and around the Great Bend of Columbia River, n. in Washington to Moses Lake, s. and w. in Oregon along the Columbia itself and up its s. affluents to lower Deschutes River; disjunctly, at ± 1350 m around basin lakes of Lake County, Oregon; and at 1500–1830 m (5000–6100 ft) around the w. margin of Lahontan Basin in Lyon, Storey, and extreme s. Washoe counties, w.-centr. Nevada; cf. Wemple, 1970, map 13. — Flowering May to July. — *Representative*: WASHINGTON: *Hitchcock & Muhlick 21,851* (NY, UC); *C. L. Hitchcock 22,593* (NY, UC); *J. W. Thompson 9256* (NY). OREGON: *Peck 17,425* (NY), *21,222* (NY, UC), *25,736* (UC); *Cronquist 6499* (NY), *7246* (NY, UC); *Eggleston 6841* (NY). IDAHO: *Nelson & Macbride 1136* (NY, UC); *Maguire & Holmgren 26,229* (NY, UC); *Barneby 15,065* (CAS, IA, NY, US); *Ripley & Barneby 6146* (NY). NEVADA: *Alexander & Kellogg 5306* (UC); *T. C. Adams 111* (UC).

Dalea ornata (Douglas) Eaton & Wright, N. Amer. Bot. 219. 1840 ("*ornatum*"), based on *Petalostemum ornatum* (adorned, showy) Douglas ex Hook., Fl. Bor.-Amer. **1**: 128. 1831. — "...on the arid Prairies near the Blue Mountains of Lewis River, North-West

America." — Holotypus, labelled "common on the barrens of the Columbia near the junction of Lewis and Clark's [= Snake] river", K (herb. Hook.)! isotypus, K (herb. Benth.)! — The specimen at GL cited by Wemple (1970, p. 66) is doubtless an isotypus also. — *Kuhniastera ornata* (Dougl.) O. Kze., Rev. Gen. 192. 1891.

Petalostemon lagopus (hare's-foot, of the softly pilose spike) Rydberg, N. Amer. Fl. **24**: 134. 1920. — "Type collected at Truckee Pass, Washoe County, Nevada, June 14, 1906, [*P. B.*] *Kennedy 1316*..." — Holotypus, NY, isotypi, UC, US!

P. ornatus fma. *pallidus* (pale, an albino variant) St. John, Northwest. Sci. **2**: 86. 1928. — "Washington: sandy flats, Plymouth, Benton Co., June 21, 1927, *H. St. John & L. A. Mullen 8644*..." — Holotypus, WSC, not seen, but verified by Wemple, 1970.

A sturdy, rather coarsely leafy herb with glaucescent foliage of thick texture and handsome, pink-tasselled knobs of flower, *D. ornata* is the only member of the genus native in the Columbia-Snake River basin, to which it would be endemic except for outliers in the lake region of transmontane Oregon and in a small disjunct area in west-central Nevada. Unlike the calciphile *D. searlsiae*, which replaces it southward from northeast and central Nevada, *D. ornata* is characteristic of soft clay and sandy soils derived from weathering of basalt and volcanic ash. I follow Wemple (1970, p. 66) in the traditional interpretation of the species and in reduction of *P. lagopus* Rydb., originally differentiated by relatively broad and short interfloral bracts, a feature found not only in Nevada but sporadically northward. The thin-textured calyces, ordinarily pilose with long shining hairs and compressed into a dense cylindric head, readily distinguish *D. ornata* from *D. searlsiae*. At its most northerly known station near Moses Lake in Grant County, Washington, *D. ornata* is represented by a notable variant (*St. John et al. 4970*, UC) with inflorescence wholly glabrous except for a minute rudiment of vesture inside the calyx-teeth. A similar variant of *D. flavescens* is noted under that species.

Already well illustrated by Abrams (1944, fig. 2770) and by Hitchcock et al, Vasc. Pl. Pac. N.-W. **2**: opp. p. 346. 1961.

34. Dalea flavescens (Watson) Welsh
(Plate LII)

Perennial from a thick woody root and shortly forked caudex, (2.5) 3–4.5 dm tall, either pilosulous throughout with weak spreading and ascending hairs up to 0.35–0.8 (1.2) mm long, or the stems glabrous and only the foliage silky-pilosulous, or glabrous to the spikes, the several erect, incurved-ascending, or diffuse, ribbed, pale green, sparsely but prominently livid-tuberculate stems leafy in the lower ½–⅔, simple except for short spurs in most leaf-axils (a few of these exceptionally developed and terminating in a small flower-spike), passing upward into a stout monocephalous peduncle, the foliage gray-green or pallid and subglaucescent, the thick-textured leaflets smooth above, punctate or verruculose beneath; *leaf-spurs* 0.2–1 mm long; *stipules* linear-lanceolate or narrowly linear, becoming stiff and fragile, 1–3.5 (4.5) mm long; *intrapetiolular glands* 2, small; *post-petiolular glands* large, obtuse; *leaves* petioled, the main cauline ones (2) 2.5–4 (4.5) cm long, with verrucose rachis and 2–3 pairs of oblong-obovate to narrowly oblong-elliptic, obtuse, emarginate, or obtuse and gland-mucronate, usually ± folded and backwardly arched leaflets up to 7–17 (19) mm long, the terminal one either stalked or sessile, commonly at least a trifle longer than the last pair; *peduncles* (4) 7–20 (25) cm long; *spikes* ovoid-oblong to oblong-cylindroid, dense and softly conelike, without petals 8.5–12 (13) mm diam, the flowers (pressed) presenting 5–7 ranks on each side of spike, the pilosulous axis becoming (1) 1.5–7 (10) cm long; *bracts* held fast between the calyces and falling only with the

fruit, subhomomorphic except the lowest slightly firmer and broader, the interfloral ones 2.5–5.5 (6.5) mm long, obovate- to oblanceolate-acuminate, below middle folded and scarious-margined, the blade flat or shallowly concave, green or castaneous, sometimes gland-sprinkled and -margined, contracted distally into a livid-castaneous, sometimes glabrescent tip, otherwise densely pilosulous dorsally, glabrous within; *calyx* (3) 3.3–4.7 (5.2) mm long, pilosulous (especially on and within the teeth) with fine, spreading-ascending hairs up to 0.35–0.95 mm long, the ovoid tube (2) 2.2–2.8 mm long, deeply recessed behind the banner, the ribs slender, scarcely prominent externally, the submembranous, pallid or castaneous-flecked intervals glandless or charged with 1–3 small colorless glands, the connivent teeth of subequal length, the dorsal one narrowest, lanceolate, (1) 1.2–2.6 (2.9) mm long, their plane tips either green or castaneous, sometimes charged with a few small blister-glands on back or margins; *petals* white when fresh (sometimes drying ochroleucous), the epistemonous ones inserted at the separation of the filaments (the dorsal pair often a trifle lower than the lateral); *banner* 5–7.4 (8.4) mm long, the claw 2.6–4.5 mm, the erect, ovate-deltate or broadly ovate, shallowly hooded, emarginate or irregularly crenate blade 2.6–4.2 (4.5) mm long, 2.2–3.9 (4.5) mm wide; *epistemonous petals* 3.8–4.6 (6.3) mm long, the claw 1–1.6 (1.8) mm, the oblong-oblanceolate, subtruncate or emarginate blades cuneately or subtruncately contracted at base, 3–3.9 (4.5) mm long, 0.9–1.6 (1.9) mm wide; *androecium* (5.5) 6.2–10 (12.7) mm long, the column (2) 2.7–3.8 (4) mm, the free filaments up to 3.4–6.2 (8.7) mm long, the connective gland-tipped, the anthers yellow, 0.9–1.6 mm long; *pod* obliquely obovoid, 3.1–3.7 mm long, the ventral suture shortest, the style-base latero-terminal or lateral, the strongly convex dorsal suture slenderly carinate around the prow, the valves hyaline in lower ¼–½, thence thinly papery, minutely gland-sprinkled, densely pilosulous; *seed* 2.1–2.4 mm long. — Collections: 16 (v).

Gullied sandy-clay benches of canyons, sandy pockets of rimrock, and sand-talus under cliffs, sometimes on dunes, associated with red or white sandstones, locally abundant in scattered stations in the canyonlands of the Colorado Plateau in s.-e. Utah, from San Rafael Swell in Emery County e. to Arches National Monument in Grand County, s. to Monument Valley in San Juan County and there crossing s. just into Arizona, and along the Colorado River itself to Rainbow Bridge and Glen Canyon in extreme e. Kane County; cf. Wemple, 1970, map 10. — Flowering May and June. *Representative*: UTAH: *Maguire 18,481* (NY, UC); *Cronquist & Holmgren 9246* (NY, widely distributed); *Welsh & Moore 7130* (NY); *Ripley & Barneby 8669* (CAS, NY); *Barneby 14,438* (CAS, GH, DAO, IA, MEXU, NY, UC, US), *15,011* (CAS, IA, NY, US), *15,022* (NY).

Dalea flavescens (Wats.) Welsh, Great Basin Nat. **31** (2): 90 (in diagnosi *D. epicae*). 1871, based on *Petalostemon flavescens* (yellowing, of the white petals when dried) Wats., Amer. Nat. 7: 299. 1873. — "Kanab [but probably further to the n.-e. in the Colorado Basin], Southern Utah (Mrs. E. P. Thompson)..." — Holotypus, GH! — *Kuhnistera flavescens* (Wats.) O. Kze., Rev. Gen. 192. 1891.

Dalea epica (of the heroic pioneers who crossed the Colorado River in 1880 near the type-station) Welsh, Great Basin Nat. **31** (2): 90, fig. 1. 1971. — "Utah: San Juan Co., Plateau, ca 10 miles east of Halls Crossing...S. L. Welsh 5205, 30 April 1966..." — Holotypus, BRY! = NY Neg. *8230*; isotypus, NY! paratypus (*Welsh 9816*), NY!

In habit and foliage *D. flavescens* resembles *D. searlsiae* and *D. ornata* but differs from both in its white petals, from the first in its permanently condensed flower-spike, and from the second in its firmer, strongly asymmetric calyx-tube. Wemple (1970, quoting an earlier

opinion of M. E. Jones) comments on the specially close relationship between *D. flavescens* and the vicariant *D. searlsiae*, which have essentially the same flower-structure. The range of *D. searlsiae* extends to the eastern margin of the Colorado canyonlands on the Pahria and Escalante Rivers, but is not known to impinge on that of *D. flavescens*.

Dissection of the Colorado Plateau into a maze of troughlike canyons, connected only by the main north-south waterway of the Colorado River, effectively cuts up the range of species endemic to the lower elevations into many discrete populations which may lie only a few miles apart by direct airline yet remain insulated from each other. This circumstance has apparently worked in concert with the variability inherent in the prairie-clovers to produce within *D. flavescens* as here understood a number of recognizable but taxonomically insignificant variants. These differ among themselves in pubescence, length and diameter of the spike, and length of calyx, petals and androecium. Most commonly, and at all known peripheral stations of the species, the foliage is more or less pilosulous, but hairy leaves may be combined with either hairy or hairless stems. In White Canyon below Natural Bridges, a form glabrous to the spikes is found close to the pubescent type, in this case not otherwise different; the variation is in this instance of the same sort as occurs in *D. searlsiae* and *D. purpurea*. Variation in flower-size is complicated by the fact that the various parts fluctuate independently. This is true especially of the free filaments, which (whatever the petal-size) may raise the anthers only half-way to the petal-tips or far beyond them. The three flowers illustrated (Pl. LII, figs. 1, 3a, 8) represent three of several known combinations. An average flower of *D. flavescens* has the calyx ± 3.5 mm long and a spike, either long and cylindroid or short and headlike, about 1 cm diam. An exceptionally large-flowered population from the Colorado rim east of Hall's Crossing of the Colorado in San Juan County, with calyx ± 5.6 mm long, long-tipped bracts to match, and a long fat spike up to 12–13 mm diameter when shorn of petals and stamens, has been described as *D. epica*; it is linked to the average sort by a collection from across the river in Garfield County (*Barneby 15,022*) with shorter but only slightly narrower spike. The type-population of *D. epica* is notable for the coincidence of pubescent foliage, densely pubescent interfloral bracts, and large epistemonous petals, a little over 6 mm long. Downstream near Rainbow Bridge a more remarkable variant (*Holmgren & Goddard 9990*, mentioned by Wemple, 1970, p. 65, and illustrated herewith, Pl. LII, fig. 8) combines the large calyx and long epistemonous petals of *D. epica* with glabrous foliage and conspicuously gland-pustulate, thinly pubescent bracts and calyx-teeth. Again a few miles downstream, near Glen Canyon City, the species is represented by a pubescent, small-flowered population hardly different from that in White Canyon already mentioned.

35. DALEA SEARLSIAE (Gray) Barneby
(Plate LIII)

Perennial herbs from a woody root and short caudex, (2.5) 3–5.5 dm tall, commonly glabrous (except for ciliolate stipules) up to the spikes, more rarely villosulous throughout with fine spreading hairs up to 0.2–0.5 mm long, the several stems either diffuse and incurved or erect and ascending in clumps, pallid, striate-ribbed, ± tuberculate, leafy through lower ½–⅓ and bearing axillary leafy spurs at most nodes, either monocephalous or some lateral shoots from near base or near middle developed and going out into a spike shorter than the terminal one, the foliage pallid green or subglaucescent, the thick-textured leaflets not or scarcely bicolored, smooth and green above, gland-tuberculate beneath; *leaf-spurs* 0.2–1 mm long; *stipules* narrowly subulate or linear, castaneous or castaneous-tipped, 1–2.5 (3) mm long, early papery and fragile; *intrapetiolular glands* present, small; *post-petiolular glands* large, prominent, obtuse; *leaves* short-petioled, the main cauline ones 2–5.5 cm long, with narrowly

thick-margined, ventrally grooved rachis and 2–3 (4) pairs of narrowly to broadly oblanceolate, oblong-elliptic, or obovate, emarginate, obtuse, or bluntly gland-mucronulate, usually folded and often backwardly arched leaflets up to 7–17 (20) mm long, the terminal one at least slightly longer than last pair; *peduncles* (2.5) 4–16 (20) cm long; *spikes* moderately dense but not conelike, the flowers (pressed) falling into ± 3–4 irregular ranks and often partially exposing the villosulous or glabrate axis, without petals narrowly oblong-cylindroid, (8) 9–11 mm diam, (1.5) 2–9 (14) cm long; *bracts* mostly deciduous by late anthesis, hardly dimorphic except the lowest a trifle firmer and broader than the rest, the interfloral ones 3–5 (6) cm long, folded and scarious at base, lanceolate or lance-caudate and firm distally, dorsally pilose, pilosulous, or glabrous, sparsely glandular, commonly livid-tipped; *calyx* (3.2) 3.5–4.6 (4.8) mm long, variably pubescent, always pilose or pilosulous on and within the teeth with weak spreading hairs up to 0.4–1.3 mm long, the ovoid tube varying from densely pilosulous to glabrous, this 2–2.8 mm long, deeply cleft behind banner, the ribs slender, not prominent, the pallid submembranous intervals often flecked with lines of castaneous cells, glandless or charged above middle with 2–4 small pale glands, the teeth of ± equal length but dissimilar in shape, the dorsal 3 lance-subulate, (0.8) 1–2.2 mm long (0.2–1.4, rarely 1.9 mm shorter than tube), the ventral pair deltate-ovate, all green or livid at tip; *petals* rose-purple, eglandular (or banner rarely charged at base of blade with 2 (4) minute glands); *banner* 5.3–7.2 mm long, the claw (2.5) 2.7–3.5 mm, the ovate, ovate-deltate, or narrowly ovate-oblong, usually subcordate, obtuse or emarginate, slightly hooded blade 2.8–3.7 mm long, 2.2–3.4 mm wide; *epistemonous petals* (3.6) 3.8–4.8 mm long, the claw 0.6–0.9 mm, the oblong or oblanceolate, truncate-emarginate or very obtuse blades either tapering or abruptly narrowed at base, (2.7) 3–4.1 mm long, (0.9) 1.1–1.6 mm wide; *androecium* 5.5–8.5 mm long, the column (2.2) 2.6–3.6 mm, the free filaments (3) 3.4–5.1 mm long, usually pink, the yellow anthers 1.1–1.5 mm long; *pod* half-obovate in profile, 3.2–4 mm long, the style-base latero-terminal, the prow moderately thickened, the valves papery except at extreme base, distally gland-sprinkled, either pilosulous or subglabrous; *seed* 2–2.8 mm long. — Collections: 59 (vii).

Dry bluffs and hillsides, sandy and rocky flats, sometimes on clay knolls of the valley floor, commonly calciphile but sometimes on sandstones and perhaps other bedrock, (1100) 1230–1980 m (3700–6600 ft), in Inyo Mts. rarely to 2280 m (7600 ft), widespread and locally abundant over the s. half of Nevada, s.-w. Utah, and adjoining California and Arizona, w. into the edge of the Mohave Desert (Providence and New York mountains), Death Valley, and Inyo Mts., n. in Nevada to Paradise Range in Churchill Co. and the Snake Range in White Pine County, s. in Arizona to Coconino Plateau in n.-w. Mohave and Coconino counties, e. up the Virgin River and through the Dixie Corridor into the w. margins of the Canyonlands, in Utah to the Pahria River and Aquarius Plateau and in Arizona to the lower Little Colorado and Painted Desert in Coconino County; apparently disjunctly around the w. margin of Salt Lake Desert in e. Elko County, Nevada, and adjoining Box Elder County, Utah; cf. Wemple, 1970, map 10. — Flowering mid-May to mid-July. — *Representative*: CALIFORNIA: *Wolf 3635* (NY, POM); *Alexander & Kellogg 1401* (NY, UC); *Roos & Roos 6167* (NY). NEVADA: *Clokey 7155, 7158* (NY, UC, widely distributed); *Maguire & Holmgren 25,409* (NY, UC); *Barneby 14,399* (CAS, NY, IA), *14,414* (CAS, NY, US); *Maguire 12,306* (NY, UC); *Holmgren, Reveal & LaFrance 2099* (NY, widely distributed). ARIZONA: *Maguire 12,238* (NY); *Barneby 14,439* (CAS, NY, IA, US); *Holmgren f. 3320* (NY and widely distributed).

Dalea searlsiae (Gray) Barneby, comb. nov., based on *Petalostemon searlsiae* (the collector) Gray, Proc. Amer. Acad. **8**: 380. 1872. — "...Pahranagat Mountains in Southeastern Nevada (about 400 miles southwest of Salt Lake)...Miss Searls... vicinity of Pahranagat mines..." — Holotypus, collected in May, 1871, GH! isotypus, K! — *Kuhnistera searlsiae* (Gray) O. Kze., Rev. Gen. 192. 1891.

A quaintly attractive but hardly ornamental plant, notable for its narrowly cylindric, amentlike spike of calyces. In habit and foliage it resembles *D. flavescens* and *D. ornata*, differing from both in the loose spike, from the latter further in its firm-textured calyx, and from *D. flavescens* further in its purple petals. The closer relationship certainly lies with *D. flavescens*, even though Rydberg (1920, p. 128, 135) assigned the two species to separate groups, artificially characterized by color of the flower. Wemple (1970, p. 61), whom I follow here in everything but nomenclature, has united Rydberg's *Ornati* and *Compacti*, and placed their members in perspective.

Over its entire range and at all known peripheral stations *D. searlsiae* has glabrous stems and foliage. It was this form that Gray described from Lincoln County, but in this very region occur populations (e. g. n. of Pioche, *Barneby 14,408*) with consistently pilosulous stems and leaves, and others (e.g. Sunnyside, n.-e. Nye County, *Barneby 14,404*) partly glabrous and partly pubescent in stem, or leaf, or both. By contrast *D. flavescens* is usually pilosulous, a glabrous phase appearing very locally near the middle of its range. Where *D. searlsiae* and *D. flavescens* converge in the drainage of the Pahria River in Kane County, Utah, each appears in its commoner guise.

The recent reduction of *D. searlsiae* to *D. ornata*, inconspicuously proposed by Welsh in the protologue of *D. epica* (q. v., under *D. flavescens*, immediately preceding) is unrealistic and unacceptable.

IIIC (iii). Series Candidae (Rydberg) Barneby

Perennial herbs, in frostless Florida sometimes weakly suffrutescent, mostly glabrous to the flower-spikes, a few thinly pilosulous, never gray-villous nor tomentulose; *leaflets* 2–20 pairs, often (but not consistently) broader than linear; *spikes* commonly dense, conelike, but in some spp. of s.-w. United States and High Prairie province loose and flexuous; *bracteoles* present, situated at base of interfloral bracts, one on each side of calyx, persistent after fall of the pod, usually puberulent, mostly up to 0.6–1.1 mm, in some rare species of S.-W. only 0.2–0.6 mm long; *calyx* glabrous externally except in some forms of *D. candida* and *D. phleoides*, the orifice either symmetrical or deeply recessed behind banner; *petals* commonly white, less often pink or pink-purple. — Spp. 9, widely dispersed over centr. and s.-e. United States between the Appalachians and the Rocky Mountain piedmont, and around the Atlantic and Gulf Coastal plains from s. Georgia and peninsular Florida to s.-e. Texas, one (*D. candida*) extending n. over the Plains to s. Canada and s.-w. into Utah, n.-e. Sonora, and Durango, one (*D. multiflora*) s. feebly from Texas into n.-e. Mexico, 3 rare and local in s.-w. Texas (Edwards Plateau and trans-Pecos) and centr. New Mexico.

Dalea subgen. **Dalea** sect. **Kuhnistera** ser. **Candidae** (Rydberg) Barneby, stat. nov., based on *Petalostemon* II. *Candidi* Rydb., N. Amer. Fl. **24**: 121, 122. 1920. — Sp. lectotypica: *P. candidus* Michx. = **Dalea candida** Michx. ex Willd. — *Petalostemon* C. *Candidi* Wemple, Iowa State Jour. Sci. **45**(1): 40. 1970.

Petalostemum [Richard in] Michaux, Fl. Bor. Amer. **2**: 48. 1803. — Generitypus: *P. candidum* Michx. — Genus conserved, as *Petalostemon*, against *Kuhnistera* Lamk. (1792). — *Petalostemon* subgen. *Petalostemon* sensu Wemple, Iowa State Jour. Sci. **45**(1): 22, 31. 1970, quoad nom.

Petalostemon I. *Carnei* Rydberg, N. Amer. Fl. **24**: 121, 122. 1920. — Sp. lectotypica: *P. carneus* Michx. = **Dalea carnea** (Michx.) Poir. — *Petalostemon* A. *Carnei* Wemple, Iowa State Jour. Sci. **45**(1): 31. 1970.

Petalostemon III. *Prostrati* Rydberg, N. Amer. Fl. **24**: 121, 122. 1920. — Sp. unica: *P. prostratus* Woot. & Standl. = (syn. tax.) **Dalea scariosa** Wats. — *Petalostemon* B. *Scariosi* Wemple, Iowa State Jour. Sci. **45**(1): 38. 1970. — Sp. unica: *P. scariosum* (Wats.) Wemple = praec.

Petalostemon IV. *Foliosi* Rydberg, N. Amer. Fl. **24**: 121, 122. 1920. — Sp. lectotypica: *P. foliosus* Gray = **Dalea foliosa** (Gray) Barneby. — *Petalostemon* D. *Foliosi* Wemple, Iowa State Jour. Sci. **45**(1): 50. 1970.

Petalostemon V. *Phleoides* Rydberg, N. Amer. Fl. **24**: 121, 122. 1920. — Sp. lectotypica: *P. phleoides* T. & G. = **Dalea phleoides** (T. & G.) Shinners. — *Petalostemon* E. *Phleoides* Wemple, Iowa State Jour. Sci. **45**(1): 54. 1970.

As will appear from the cited synonymy, I here unite into one relatively heterogeneous series *Candidae* five species-groups of unspecified status first defined by Rydberg and maintained essentially intact by Wemple. The series, now characterized principally by the presence of spiculiform bracteoles which persist on the spike axis after fall of bracts and calyces (cf. Pl. LVI, figs. 2, 10) and (with a few exceptions) by an externally glabrous calyx, becomes somewhat diverse internally, but hardly more so than the numerically smaller ser. *Compactae* whether as defined by Wemple or with *D. obovata* removed, as in this paper. The original nucleus of *Candidi* Rydb. differed from *Carnei* Rydb. in the less oblique calyx and scoop-shaped rather than obcordate banner-blade, excellent specific characters which, if applied at serial level through the genus, would entail an inconvenient and unrealistic proliferation of monotypic groups equivalent in my view to comprehensive specific units. Since group *Carnei* has from the first included both white-flowered and pink-flowered members, the only solid differential character of the pink- or purple-flowered group *Foliosi* is a high number of leaflets; but if *Foliosi* is enlarged to admit alongside *D. sabinalis* the very closely related *D. bartoni*, which has but 2–3 pairs of leaflets, the character evaporates. Once an oblique calyx is introduced to *Candidae* by inclusion of group *Carnei* and numerous leaflets by *D. foliosa*, it becomes impossible to exclude group *Phleoides*; the striking obliquity of the calyx in *D. phleoides* seems to be little more than an exaggeration of that already achieved in *D. sabinalis* and its close relatives, which have in addition similar gland-patterns in the panels of the calyx-tube. The monotypic group *Prostrati* Rydb. (= *Scariosi* Wemple) has been treated as though greatly isolated in the genus, although Wemple has perceived its affinity to *D. sabinalis*. The calyx is, in fact, almost identical to that of *D. sabinalis* and the now described *D. bartoni*, the idiosyncratic facies of *D. scariosa* arising from the diffuse habit and prolific branching, many secondary axes going out into spikes of flower. This type of branching, even though on more erect rather than diffuse stems, makes an independent appearance in *D. multiflora*, an original and unchallenged member of group *Candidi* which scarcely differs from *D. candida* itself in any other major feature. Upon examination all of these little species-groups are seen to be linked by pairs of matching characters that recur in different contexts and under differing combinations, a situation already encountered in ser. *Compactae*.

The discontinuity between ser. *Candidae* and ser. *Compactae* is slight and highly technical, really hingeing on presence of developed bracteoles. These bracteoles are in *D. scariosa* and *D. bartoni* sometimes poorly developed, and the similarity between these species of ser. *Candidae* and *D.* (*Compactae*) *searlsiae* in the asymmetric calyx and loose flower-spike suggest passage between the two series. Furthermore *D. searlsiae* is the only member of *Compactae* with an externally glabrate calyx. On the other hand it harmonizes with other *Compactae* in habit, foliage, and ecology, and a line drawn between the series that will separate *D. searlsiae* from *D. scariosa* appears, even if not entirely natural, the most practical.

The series *Candidae* is more sharply differentiated from the sympatric series *Purpureae*, all of which have densely pubescent calyces or at least remnants of the vesture in the shape of a fine plush along the angles of the tube and edges of the teeth. No *Purpureae* have either bracteolate flowers or white petals.

Key to the Species of Ser. *Candidae*

1. Calyx multiglandular externally, the intercostal panels of the tube all charged with more than 1 gland, those of the broad panels below the ventral pair of teeth with at least 3, usually several glands; *orifice* of calyx strongly oblique, the points of the teeth crowded together toward the abaxial side; Texas (and weakly into states adjacent n.-e. and e.) and New Mexico.
   2. Spikes relatively loose, the flowers ascending, the interfloral bracts deciduous before anthesis, the calyces not closely contiguous and not concealing the axis of spike; *leaflets* 2–7 (8) pairs, if over 5 pairs then linear-oblanceolate and petals pink; *epistemonous petals* obovate, 1.2–2.2 mm wide; *calyx* in profile obovate-pyriform, when dry constricted and ± pleated at base; rare and local species of s. Edwards Plateau and trans-Pecos regions in Texas or of Rio Grande valley in n.-centr. New Mexico.
      3. Leaflets of cauline leaves 2–4 (5) pairs, obovate-cuneate, folded, 2.5–8 mm long; *stipules* 0.2–1.5 mm long; *peduncles* 0–5 cm long; trans-Pecos Texas and New Mexico. Spikes and color of petals various.
         4. Stems 2–7 dm long, freely branched, many of the lateral branches terminating in a spike; *leaflets* mostly 3–4 (5) pairs; *spikes* elongate, many-flowered, the axis 1.5–9 (13) cm long; *petals* pink-purple; local on bluffs of Rio Grande in Bernalillo and Valencia counties, New Mexico. 36. *D. scariosa* (p. 237)
         4. Stems 1–2.5 dm long, simple except for a few sterile spurs, hence monocephalous; *leaflets* 2–3 (4) pairs; *spikes* subcapitately 7–20-flowered, the axis 3–14 mm long; *petals* white; local in Brewster County, Texas. 37. *D. bartoni* (p. 238)
      3. Leaflets of cauline leaves 5–7 (8) pairs, linear-oblanceolate, usually plane, 8–15 mm long; *stipules* 2–4 mm long; *peduncles* mostly 6–12 mm long; s. margins of Edwards Plateau, Texas, between Devils River and San Antonio. Spikes solitary and terminal as in *D. bartoni* but the stems 2–6 dm long and the spikes loosely many-flowered and elongate as in *D. scariosa*; *petals* pink. 38. *D. sabinalis* (p. 240)
   2. Spikes dense, the horizontal or slightly declined calyces closely contiguous, concealing axis of spike, and holding fast between them the interfloral bracts which fall only with the ripe pod; *leaflets* 6–20 pairs, if 8 or less pairs in some primary cauline leaves then broader than linear-oblanceolate; *epistemonous petals* white, linear-oblong, less than 1 mm wide; *calyx* in profile obliquely deltate, neither constricted or obviously pleated at base; polymorphic species of centr. and e. Texas mostly n. and s.-e. of Edwards Plateau, extending weakly into Oklahoma and Louisiana. 39. *D. phleoides* (p. 241)

1. Calyx eglandular externally, or the intercostal panels of tube charged well above middle with 1, rarely 2 glands; orifice of calyx not or only moderately oblique, the sinus behind banner sometimes deeply recessed but the teeth not crowded together toward the abaxial side; species of wide range, sympatric with the last but extending to Canada, n. Mexico, and the Atlantic Coastal Plain.

5. Leaflets of primary cauline leaves 9–15 pairs; *species* local in mid-western United States (n.-e. Illinois; centr. Tennessee and n. Alabama); *petals* purple. 40. *D. foliosa* (p. 244)
5. Leaflets of all leaves 2–5 (6) pairs; *species* of wide range; *petals* white, or pink only in Florida and Georgia.
   6. Blade of banner deltate-obcordate, with broad blunt descending lobes; *orifice* of calyx scarcely or not oblique, the sinus behind banner scarcely deeper than the rest; *calyx* (dry) usually strongly pleated below the teeth; *petals* always white; Kentucky and s.-centr. Alabama far w., n.-w. and s.-w.
      7. Spikes of each major stem-axis usually numerous, always short, globose or shortly oblong, the axis up to 1 (1.2) cm long; *leaflets* of primary cauline leaves 3–6, usually 4 or 5 pairs; widespread over Texas between the eastern sylvan belt and the High Plains, s. into n.-e. Mexico, n. through Oklahoma into e.-centr. and e. Kansas and adjoining Missouri. 42. *D. multiflora* (250)
      7. Spikes all, or at least the first one of each major axis well over 1.5 cm long (if rarely less then remotely allopatric); *leaflets* of primary leaves 2–4 pairs, if 4 pairs the spikes decisively longer and usually fewer than those of the preceding; species of extremely wide range, present throughout that of *D. multiflora* but extending e. to Alabama and Illinois, n.-w. to s. Canada, s.-w. to Utah, extreme n. Sonora, and Durango. 41. *D. candida* (p. 246)
   6. Blade of banner scoop-shaped, broadly cuneate to truncate at base; *calyx* at anthesis bluntly pentagonal, the ribs not or scarcely prominent; *orifice* of calyx strongly oblique, the sinus behind banner deeply recessed; *calyx-tube* at anthesis bluntly pentagonal, the ribs not or scarcely prominent, hence not pleated; Atlantic and Gulf Coastal plains from centr. Georgia to s. peninsular Florida, e. just into lower Louisiana.
      8. Leaflets of primary cauline leaves linear-elliptic, mostly navicular, at least 1 mm wide when laid out or 0.5 mm wide in profile; *spikes* varying from globose to oblong, but if globose the petals white; range as given in the last. 43. *D. carnea* (p. 252)
      8. Leaflets of primary leaves linear, involute and vermiform, less than 0.5 mm diam; *spikes* all subglobose; *petals* always pink-purple; extreme s.-e. Georgia and peninsular Florida. 44. *D. feayi* (p. 256)

36. Dalea scariosa Watson

(Plate LIII)

Diffuse perennial herbs from a stout woody root and shortly forking caudex, glabrous up to the puberulent inflorescence, the decumbently radiating and assurgent, striate-angular, pale green or stramineous, gland-tuberculate stems 2–7 dm long, freely branching into fan-shaped sprays, the spikes mostly terminal to branchlets, the foliage pallid, thick-textured, the leaflets yellow-green above, glaucous and punctate beneath; *leaf-spurs* 0.2–0.6 mm long; *stipules* triangular-subulate, 0.2–1.5 mm long, early becoming papery, castaneous, deciduous; *intrapetiolular glands* 0; *post-petiolular glands* prominent, obtuse; *leaves* slender-petioled, 1–2.5 cm long, the tuberculate rachis narrowly thick-margined, the leaflets (2) 3–4 pairs, obovate-cuneate, emarginate, loosely folded, 3–8 mm long; *peduncles* 0.5–4 (5) cm long; *spikes* moderately loose or early becoming so, the calyces (pressed) falling into 2–3 ranks, at first

narrowly ovoid becoming cylindric or catkinlike, without petals or androecia 9–11 mm diam, the puberulent axis at length 1.5–9 (13) cm long; *bracts* early deciduous, elliptic- or ovate-acuminate, 2.5–5 mm long, dry and brownish with minutely lacerate scarious margins, dorsally glabrous and sparsely glandular, ciliolate; *calyx* 4–5.8 mm long, in profile obovate-pyriform, glabrous except for the internally short-pilosulous teeth and orifice, the tube 3–3.8 mm long, recessed behind banner, plicate at the narrow base but (when fresh) only low-ribbed and not corrugated distally, the ribs subfiliform, immersed distally, the intervals pale green, herbaceous, charged with one row of 3–5 (or the ventral pair with 2–3 rows of several) golden or reddish blister-glands, the teeth of ± equal length, 1.1–2 mm long, the dorsal one and lateral pair subulate, the ventral pair broadly triangular- or deltate-apiculate, all spurless; *petals* all lilac-pink or pale rose-purple, the banner sometimes charged with a subapical gland; *banner* 7.2–8 mm long, the claw 3.2–3.8 mm, the suborbicular-cordate, distally hooded and shallowly emarginate blade ± 4– 4.5 mm long and wide; *wings* 4.2–4.4 mm long, the claw 0.4–0.5 mm, the obovate blade 3.7–4 mm long, 2–2.2 mm wide; *keel-petals* ± 4.8 mm long, the claw 0.7–1.1 mm, the oblong-obovate blade 3.7–4 mm long, ± 1.8 mm wide; *androecium* 5 (according to Standley sometimes 6)-merous, 8.5–9.8 mm long, the column 3.5–4.5 mm, the free filaments up to 5–5.4 mm long, pinkish; *pod* 3.2–4 mm long, in profile half-obovate, the ventral suture concavely and the dorsal one strongly convexly arched, the valves in lower third subhyaline, thence papery, pale-green, gland-sprinkled, glabrous except for a short beard along ventral suture and base of style; *seed* 2.3–3 mm long; 2n = 14 (Mosquin). — Collections: 4 (i).

Gullied sand and cobblestone bluffs along the upper Rio Grande, at ± 1460–1510 m (4900–5030 ft), local, known only from the neighborhood of Albuquerque and Belen, Bernalillo and Valencia counties, New Mexico. — Flowering August and September. — *Material*: NEW MEXICO. Bernalillo: Albuquerque, *Rusby in 1909* (NY, 3 sheets); typi of *D. scariosa* and *Petalostemon prostratus*. Valencia: Belen, *Barneby 13,842* (CAS, DAO, GH, IA, MEXU, MICH, NY, US).

Dalea scariosa (scarious, of the bracts) Watson, Proc. Amer. Acad. **17**: 369. 1882. — "Near Albuquerque, New Mexico; Rev. E. L. Greene, 1877. — Holotypus, GH! isotypus (fragm), NY! — *Parosela scariosa* (Wats.) A. Hell., Cat. N. Amer. Pl., ed 2, 6. 1900; Rydb., N. Amer. Fl. **24**: 94. 1920, as comb. nov. *Petalostemon scariosum* (Wats.) Wemple, Iowa State Jour. Sci. **45** (1): 38, map 4. 1970.

Petalostemon prostratum (prone, of the stems) Wooton & Standley, Contrib. U. S. Nat. Herb. **16**: 138. 1913. — "Type in the U. S. National Herbarium, no. 370697, collected near Albuquerque in 1909 by Winnie Harward (no. 17)." — Holotypus, so labelled, US!

37. DALEA BARTONI Barneby

(Plate LIV)

Dwarf, tufted perennial herbs from stout woody roots and a greatly enlarged, knotty caudex up to 3 cm diam, glabrous to the ciliolate orifice of the calyx, the many slender, striate dotted but not tuberculate, simple or occasionally weakly spurred stems 1.2–2.5 dm long, by anthesis leafless at base, but thence equably leafy up to the usually solitary (rarely 2–3) terminal headlike spikes, the foliage pallid or yellowish green, the thick-textured leaflets smooth above, multipunctate beneath; *leaf-spurs* 0–0.4 mm long; *stipules* triangular-subulate 0.2–1.2 mm long, early becoming brown

and deciduous; *intrapetiolular glands* small, immersed; *post-petiolular glands* small or 0; *leaves* petioled, the primary cauline ones 8–20 (23) mm long, with narrowly green-margined, ventrally grooved rachis and 5–9 oblanceolate to obovate-cuneate, emarginate, folded and backwardly arched leaflets 2.5–7.5 mm long, the terminal leaflet either sessile or minutely stalked, the uppermost leaves like those of some axillary branchlets often smaller and 3-foliolate; *peduncles* 1–6 mm long; *spikes* shortly 5–30-flowered, subglobose to shortly oblong, without petals ± 8 mm diam, the calyces spreading-ascending, the axis becoming 3–14 mm long; *bracts* dimorphic, the lowest persistent, ovate, ± 2 mm long, the (little known) interfloral ones early deciduous, papery-castaneous except for narrow membranous margins near base, up to 3 mm long; *spicular bracteoles* 0.2–0.5 mm long; *calyx* obliquely obovoid-pyriform, 3.8–4.3 mm long, glabrous externally, at base broadly obconic, gray-glaucescent, and (dry) ± pleated, thence castaneous and charged between the slender, immersed ribs with prominent yellow glands, these ± 1-seriate in the narrower panels, numerous and scattered in the broad adaxial ones, the tube 2.8–3.5 mm long, strongly oblique at orifice, the sinus behind banner shallowly recessed but much broader than the rest, the 3 abaxial teeth narrowly triangular-subulate, 0.7–1 mm long, the ventral pair shorter, broadly deltate, all densely ciliolate and internally pilosulous with silvery hairs up to ± 0.2 mm long; *petals* white, glandless, the epistemonous ones perched at separation of the filaments; *banner* ± 5.4 mm long, the filiform claw 3 mm, the deltate-obcordate, distally hooded blade 2.5 mm long, 3 mm wide; *epistemonous petals* all similar (the abaxial pair slightly larger), ± 3.7 mm long, the obovate blades ± 3 mm long, 1.5 mm wide, cuneately narrowed at base into a claw less than 1 mm long; *androecium* 9.5 mm long, the column 4 mm, the free filaments up to 4.5 mm long (anthers not seen); *pod* half-obovoid, ± 2.8 mm long, the ventral suture nearly straight, the dorsal one strongly convex and slenderly keeled along the prow, the valves membranous but heavily castaneous-flecked in lower ⅓, thence firm, thinly and minutely appressed-pilosulous along the abaxial curve, densely short-barbate at apex and along base of style; *seed* nearly 2 mm long. — Collection: 1 (typus).

On limestone at ± 1080 m (3900 ft), reportedly rare, known only from the type-locality in Brewster County, trans-Pecos Texas. — Flowering in July.

Dalea bartoni (Barton Holland Warnock, 1911– , creator of the SRSC herbarium) Barneby, sp. nov., *D. sabinali* Wats. necnon *D. scariosae* Wats. arcte affinis sed huic propior, ab illa foliolis paucis 2–4-jugis obcuneatis parvis 2.5–7.5 mm (nec 5–8-jugis linearioblanceolatis 8–15 mm) longis, caulibus nanis vix 2.5 (nec 2–6) dm longis, stipulis parvulis, ab hac caulibus nanis simplicibus monocephalis (nec 2–7 dm longis diffuse multiramosis polycephalis), ab ambabus spica pauciflora capitata subsessili petalisque albis absimilis. — Texas. Brewster: limestone soil on C. F. Cox Ranch, alt. 3600 ft, fr. with a few late flowers, Jul 31, 1953, *Barton H. Warnock 11,398*. — Holotypus (2 sheets), SRSC; isotypi, IA (fragm), NY, TEX.

The type collection of *D. bartoni* as represented at TEX was identified by Wemple as *Petalostemon sabinale*, and is apparently the basis of the Brewster County record for that species mentioned in his revision (1970, p. 54) but omitted from the map (1970, p. 39). While the calyces of these two prairie-clovers are undeniably similar and their kinship not in question, *D. bartoni* differs in so many characters of stature, foliage, length of spike, and petal-color, that I cannot accomodate it in the same species as *D. sabinalis*. The really close relationship of *D. bartoni* is believed to lie rather in the direction of *D. scariosa*, a species hitherto considered greatly isolated, both taxonomically and geographically, in fact referred by Wemple to a monotypic series in *Petalostemon*. The calyces, however, of *D. scariosa, D. bartoni*, and *D. sabinalis* are essentially identical, and the three entities

form a little group within sect. *Kuhnistera* ser. *Candidae* which could be treated in either of two ways: as a polymorphic single species comprising three geographically disjunct races, or as a set of three autonomous species, obviously related but separated by a substantial set of morphological discontinuities. The differences are of the same order as exist between, for example, *D. feayi* and *D. carnea*, or *D. candida* and *D. multiflora*, differences that is of foliage, habit, and size or arrangement of the spikes, but involving no obvious structural modification of the flower. In the context of sect. *Kuhnistera*, *D. bartoni* emerges as a well differentiated species.

The unique features of *D. bartoni* are the short, slender, almost always monocephalous stems less than 2.5 dm long, the reduction of the spike to a subsessile, capitate or shortly oblong head of 5–30 flowers, and the white (not pink or lilac) petals. The foliage and short stipules resemble those of *D. scariosa* closely, but the stems of the latter are characteristically longer and freely branched, forming cartwheels of foliage 5–15 dm in diameter, each branchlet going out into loose, many-flowered, ament-like rather than headlike spike of lively pink flowers. The known range of *D. scariosa* lies at ± 1500 m along a 50 km stretch of the Rio Grande valley in north-central New Mexico, its nearest point 550 km distant from *D. bartoni*. The differential characters of *D. sabinalis* are the longer stems (2.5–6 dm), longer stipules (2–3.5 mm), 5–8 pairs of linear leaflets up to 7–15 (not 2.5–7.5) mm long, and an elongate, many-flowered spike of pink flowers becoming 4–9 cm long and elevated beyond the uppermost cauline leaves on a naked peduncle about 5–12 cm long. The known range of *D. sabinalis* extends around the south edge of Edwards Plateau at elevations near and below 500 m, its most western station being in the drainage of Devils River about 200 km east of *D. bartoni*.

Professor Warnock, who kindly loaned the material in his herbarium, tells me that the type-locality is on limestone in the pinyon belt and situated about 20 miles west of Sanderson, probably in the drainage of San Francisco Creek, near the common boundary point of Terrell, Brewster, and Pecos Counties. It is a pleasure to associate this charming dalea with the name of the collector, who has done so much to make known the rich endemic flora of trans-Pecos Texas. There is already a *Dalea warnockii*, but synonymous with *D. wrightii* Gray.

38. Dalea sabinalis (Watson) Shinners
(Plate LIV)

Perennial herbs 2.5–5 (6) dm tall, glabrous up to the ciliolate orifice of the calyces, the smooth or distally striate, sparsely gland-sprinkled but scarcely verruculose stems diffuse or assurgent, at anthesis leafless at base but equably leafy thence up to the solitary terminal spike, a few upper leaf-axils sometimes giving rise to short sterile branchlets, the foliage glaucescent, the thick-textured leaflets smooth above, pallid and finely brown-punctate beneath; *leaf-spurs* 0.1–0.6 mm long; *stipules* linear-caudate, (0.8) 1.2–3.5 mm long, early dry and fragile; *intrapetiolular glands* minute, impressed, sometimes 0; *post-petiolular glands* small, prominulous; *leaves* short-petioled, the main cauline ones 2–4 cm long, with narrowly margined, ventrally grooved rachis and 5–8 pairs of linear-oblanceolate, bluntly gland-mucronulate leaflets 7–15 mm long, the leaves of axillary spurs, if present, shorter, with fewer smaller leaflets; *peduncles* 6–12 cm long; *spikes* many-flowered, becoming moderately loose, without petals 6.5–8 mm diam, the spreading-ascending calyces not concealing the glabrous axis, this becoming 4–9 cm long; *bracteolar spicules* 0.4–0.7 mm long; *calyx* 3–3.3 mm long, obliquely obovoid-pyriform, glabrous externally, the gray-glaucescent tube glabrous, eglandular, 2.3–2.5 mm, pleated when dry, the recessed

dorsal sinus broader than the rest, the 3 ventral teeth narrowly triangular-subulate, the 2 ventral ones deltate-acuminulate, all externally gland-pustulate, minutely ciliolate; *petals* pink, in size and shape as those of *D. bartoni*; *androecium* 5–6 mm long, the column and free filaments of subequal length; *pod* very obliquely obovoid, ± 3 mm long, the style-base latero-terminal, the short ventral suture concave, the strongly bowed dorsal one slender-keeled around the convex prow, the valves membranous but heavily castaneous-lineolate in lower ⅓, thence firm, minutely gland-verruculose, glabrous except for the minutely ciliolate ventral suture and style-base; *seed* 1.5–2.1 mm long. — Collections: 4 (o).

Open hillsides on limestone, rare and local around the s. edge of Edwards Plateau in Val Verde, Uvalde, and Bandera counties, in s.-w. Texas. — Flowering April–May. — *Material*: TEXAS. Val Verde: 8⅔ mi. s. of Loma Alta, *Cory 41658* (GH); 12¾ mi. s. of Loma Alta, *Cory 44424* (TEX). Uvalde: "Chalk Bluffs", *E. J. Palmer 13337* (US). Bandera: typus.

Dalea sabinalis (Wats.) Shinners, Field & Lab. **17**: 83. 1949, based on *Petalostemon sabinale* (of the type-locality) Wats., Proc. Amer. Acad. **21**: 448. 1886 ("*Sabinalis*"). — "Collected by J. Reverchon in Bandera County, Texas, at the entrance to Sabinal Cañon, June, 1885 (n. 45)." — Holotypus, GH! — *Kuhnistera sabinalis* (Wats.) A. Hell. Bull. Torrey Club **23**: 124. 1896.

A rare species, seldom collected and poorly understood, but evidently a close relative of the allopatric Texan *D. bartoni* and the New Mexican *D. scariosa*, all having the same asymmetric calyx, glabrous below the ciliolate orifice, and except for the white coloring of *D. bartoni*, essentially the same perianth. Rydberg and Wemple (under *Petalostemon*) each associated *D. sabinalis* with *D. foliosa*, but I suspect a nearer bond with *D. phleoides*, in which the asymmetry of the calyx is only a trifle exaggerated; whereas the calyx of *D. foliosa* is that of *D. candida*.

The growth-habit of *D. sabinalis*, as often in *Dalea*, is difficult to interpret from herbarium specimens. Wemple (1970, p. 54) describes the stems as erect and they may perhaps sometimes be so, but those of *Cory 44424*, with their recurved leaves and flexuously incurving spike-axes appear to have been humifuse or assurgent like those of *D. scariosa*. The point requires study in the field.

39. DALEA PHLEOIDES (Torrey & Gray) Shinners
(Plate LIV)

Perennial herbs of rapid growth, sometimes flowering the first season, with orange-red taproot and short caudex, (2.5) 3–7 dm tall, variably pubescent but at least the stems distally, or the leaf-rachis, or the upper face of leaflets (or some of them) ± densely pilosulous with weakly sinuous or incurved hairs up to 0.25–0.6 (0.7) mm long, the diffuse and ascending, ribbed, prominently livid-tuberculate stems either simple except for sterile branchlets in most axils or branched near middle, leafy in the lower ½–⅔, the foliage green or grayish-green, scarcely or strongly bicolored, the leaflets when dried either pale or verdigris above, livid-verruculose beneath; *leaf-spurs* 0.2–1.2 mm long; *stipules* narrowly subulate to linear-lanceolate or -caudate, castaneous, becoming dry and fragile, 1–4 mm long; *intrapetiolular glands* minute or 0; *post-petiolular glands* prominent, obtuse; *leaves* very shortly petioled, the primary cauline ones 2.5–5.5 (6.5) cm long, with narrowly margined, tuberculate rachis and 6–20 (24) pairs of oblong, oblanceolate, or oblong-elliptic, obtuse or bluntly gland-mucronulate, or emarginate, flat or loosely folded leaflets 2.5–11 (14) mm long, the

leaves of axillary fascicles or branchlets shorter, with fewer smaller leaflets of same type; *peduncles* (1) 2–20 (25) cm long; *spikes* very dense, the calyces contiguous, in outline at first long and narrow becoming ± sinuous in age, without petals 5.5–7.5 (8.5) mm diameter, the densely pilosulous to glabrous axis (1.5) 2.5–9 (13) cm long; *bracts* subdimorphic, the lowest firm and persistent, the interfloral ones deciduous but held fast between the calyces and falling with them, these narrowly lance-acuminate or -caudate, 2.5–4.5 mm long, subscarious toward base, livid-castaneous distally, dorsally pilosulous and ± glandular, the slender tips either as long as the buds or well exserted before anthesis; *calyx* very obliquely compressed-ovoid, spreading subhorizontally or declined from the axis of the spike, 2.5–3.8 mm long, the tube measured to a lateral sinus 1.7–2.5 (2.8) mm long, deeply recessed behind banner, either glabrous or pilosulous externally (the hairs up to 0.2–0.45 mm long), the subfiliform ribs castaneous, hardly prominent, the rather firm, often castaneous-flecked intervals very unequal, the dorsal and lateral ones narrow, charged above middle with 1–2 glands, the broad ventral ones with 3–5 (7) scattered glands, the teeth all crowded toward the abaxial side of the orifice, up to 0.5–1.2 mm long, of nearly equal length but dissimilar in shape, the 3 abaxial ones subulate, the adaxial pair broadly deltate-ovate, all usually glabrous externally, within always pilosulous; *petals* white, glandless, the epistemonous ones perched at the sinuses between filaments, the abaxial pair slightly higher than the lateral; *banner* 5.3–6.8 mm long, the claw (2.5) 3–3.8 mm, the bluntly deltate, deeply cordate, often apically emarginate and hooded blade 2.8–3.5 (4) mm long, 2.6–3.6 (5.2) mm wide; *epistemonous petals* all alike or the inner pair a trifle larger, 4.1–5.9 mm long, the linear-oblong or -oblanceolate, ribbon-like blades 0.5–0.9 mm wide, tapering at base into a claw 1.1–2 mm long; *androecium* 5.2–7.4 mm long, the column (1.8) 2–3.2 mm long, the free filaments up to 3–4.3 (4.8) mm long, the connective gland-tipped, the pale yellow or orange-yellow anthers 0.6–0.9 mm long; *pod* obliquely obovate in profile, ± 2.5–2.9 mm long, the style-base terminal, the prow slenderly carinate, the valves papery, scarcely transparent at base, pilosulous and sometimes gland-sprinkled distally.

A white prairie-clover instantly recognized by its many leaflets, firm narrow spikes of crowded, strongly asymmetric calyces, and ribbon-like epistemonous petals. The calyces stand out horizontally from the axis of the spike and present to exterior view, in place of the five-lobed orifice usual in *Dalea*, a vertical ciliate slit formed by the margins of the inner calyx-teeth, the points of these and of the abaxial teeth being all crowded together at the nether extremity. The species is morphologically very distinct and was found by Wemple (1970, p. 8) to be isolated by genetic incompatibility from other members of the group *Candidi*.

My concept of *D. phleoides* is equivalent to *Petalostemon* group *Phleoides* of Wemple (1970, pp. 54–57, map 8) who, quoting an unpublished study by W. S. Jackson, recognized within it two species, *P. phleoides* and *P. microphyllum*. Both were known to be highly variable internally, seeming to consist of a mosaic of races differing among themselves in pubescence, number or size of glands and of leaflets, and size of calyx. Most of the phenotypic variables are weakly correlated if at all, but relatively few and large leaflets seem to go hand in hand with a calyx externally glabrous and grossly glandular; these removed as *P. phleoides*, the residue, with calyx sometimes hairy all over, sometimes only near the base, combined with smaller and more numerous leaflets but still heterogeneous in other respects, is defined as *P. microphyllum*. Sorted in this way, the two types are found to have substantially different but at same time widely overlapping ranges of dispersal and where they overlap a common habitat. The forms with fewer larger leaflets, in which a sort of leafy impulse is often expressed upwardly on the peduncle in the shape of enlarged

bracteiform stipules (or stipuliform bracts) and elongated true interfloral bracts, is confined to the sandy woodlands of the Gulf Coastal Plain, whereas *P. microphyllum*, pubescent like *P. phleoides* where they grow together, extends northward and far inland to the Red River and north foothills of Edwards Plateau, where the foliage becomes often hairless or almost so. Wemple and Jackson assume that the individual populations of either entity have little contact, and explain the internal variability of both in terms of isolation of breeding-lines. The same circumstances would enable two related species to maintain themselves in pure form even though they are adapted to the same environment and are in practice sympatric. On the other hand a shift of emphasis from the small differences, acknowledged variable in themselves, to the multiple and constant similarities, justify a return to the original varietal status accorded to *P. microphyllum* on its discovery. The sorts of phenotypic variation encountered in *Dalea phleoides* sens. lat. are encountered repeatedly in Amorpheae: the foliose tendency, exhibited also, in the same territory, by the purple prairie-clover *D. compacta*; and that often misleading and inscrutable variability in pubescence to which I have given prominent attention throughout this account.

Key to the Varieties of *Dalea phleoides*

1. Primary cauline leaves with 6–10 (12) pairs of leaflets up to 5–14 mm long; *axis of spike* and exterior of *calyx* glabrous or almost so. 38a. var. *phleoides*.
1. Primary cauline leaves with 12–20 (24) pairs of leaflets up to 2–7 mm long; *axis of spike* and *calyx-tube*, at least at base, often throughout, pilosulous with spreading-incurved hairs. 38b. var. *microphylla*.

39a. DALEA PHLEOIDES (Torrey & Gray) Shinners var. PHLEOIDES (Plate LIV)

Characters as given in key; 2n = 14 (Turner, 1959, as *P. glandulosum*); n = 7_{II} (Mosquin). — Collections: 14 (o).

Open places in sandy woodlands, sometimes in old fields and along waysides, below 250 m, local but colonial, s.-e. and e. Texas, from the lower Guadelupe River n.-e. to the lower Neches and upper Sabine rivers; reported by Wemple (1970, map 8) from one locality in the Rio Grande valley in or near Maverick County. — Flowering May to July. — *Representative*: TEXAS: *T. & L. Mosquin 5811* (NY); *Wemple & Jackson 660, 666, 692-1* (NY); *Reverchon 2667* (NY); *B. L. Turner 3891* (TEX, WIS); *Drummond 131* (K, NY); *E. Hall 136* (NY).

Dalea phleoides (Torrey & Gray) Shinners, Field & Lab. **17**: 83. 1949, based on *Petalostemon phleoides* (resembling timothy-grass, of the narrow flower spike) T. & G., Fl. N. Amer. **1**: 310. 1838. — "Arkansas, *Dr. Leavenworth*." — Holotypus, NY (herb. Torr.)! — *Kuhniastera phleoides* (T. & G.) O. Kze., Rev. Gen. 192. 1891. *Petalostemon aphleoides* (sphalm.) Young, Fl. Tex. 221. 1873.

Petalostemon glandulosus (glandular, of the calyx) Coulter & Fisher, Bot. Gaz. **18**: 299. 1892. — "Eastern Texas, at Hockley (*F. W. Thurow*, in 1890), and at Industry (*H. Wurzlow*, in 1892)." — Lectotypus (Wemple, 1970, p. 55), *Frederick William Thurow in 1890*, US! paratypus (*Wurzlow*), NY. — *Dalea glandulosa* (Coult. & Fish.) Shinners, Field & Lab. **17**: 83. 1949, a later homonym of *D. glandulosa* (Blanco) Merrill, 1905.

Petalostemon candidus var. *multifoliolatus* Gray ex E. Hall., Pl. Tex. 7. 1873, nomen. — Based on *Hall 136*, cited supra.

There seem to be no modern collections from the present state of Arkansas. Leavenworth, however, is known (McVaugh, Field & Lab. **15**: 67. 1947) to have collected in the Neches and Angelina valleys in eastern Texas in 1834 and 1837, and therefore passed through part of the contemporary range of the species.

The reduction of *P. glandulosus*, first proposed by Heller in 1896, was accepted by Wemple and is not disputed.

39b. Dalea phleoides (Torrey & Gray) Shinners var. microphylla (Torrey & Gray) Barneby

(Plate LIV)

Characters as given in key. Collections: 18 (i).

Prairies, open woodlands, dunes, beaches, from near sea-level up to ± 525 m (1750 ft), widely but discontinuously dispersed in Texas from the Gulf Coast between Corpus Christi and Galveston bays n. and n.-e., apparently avoiding the calcareous formations of the Edwards Plateau to the Red River calley in Montague County, Texas and the Oklahoma side of the river in Marshall County, w. to the sources of Brazos River near Abilene. — Flowering May to July. — *Representative*: Oklahoma: *Goodman 6152* (NY, OKLA, UC). Texas: *Reverchon 1949, 1949a* (NY); *Lindheimer s. n. in 1843* (GH, NY, UC); *E. Hall 137* (NY); *Whitehouse 10056* (NY, UC); *Wemple 245* (NY, TEX), *249* (NY); *Tharp 128d* (NY, UC).

Dalea phleoides (Torrey & Gray) Shinners var. **microphylla** (Torrey & Gray) Barneby, comb. nov., based on *Petalostemon phleoides β microphyllum* (with small leaflets) T. & G., Fl. N. Amer. **1**: 310. 1838. — "Texas, Drummond." — Holotypus, *Drummond 126* of Coll. II, summer 1835, NY (herb. Torr.)! isotypi, some ascribed to Coll. III, K, W! — *Kuhnistera microphylla* (T. & G.) A. Heller, Bull. Torrey Club **23**: 122. 1896. *Petalostemon microphyllus* (T. & G.) A. Heller, Bull. Torrey Club **26**: 593. 1899. *Dalea drummondiana* (Thomas Drummond, 1789–1835) Shinners, Field & Lab. **17**: 83. 1949, a legitimate substitute (non *D. microphylla* H. B. K.).

40. Dalea foliosa (Gray) Barneby

(Plate LV)

Leafy perennial herb 3–8 dm tall, glabrous to the inflorescence, the stout erect and incurved-ascending, angular-ribbed, pallid or purplish stems either spurred or branched near middle, always paniculately branched distally, the spikes terminal to all upper branchlets, the foliage green, the leaflets somewhat bicolored, dark (when dry often verdigris) green above, paler and punctate beneath; *leaf-spurs* 0.5–1.8 mm long; *stipules* linear-lanceolate or setiform, 1.5–5.5 mm long, becoming dry and brittle; *intrapetiolular glands* small; *post-petiolular glands* small but prominent, obtuse; *leaves* sessile or almost so, the primary cauline ones 3–5.5 cm long, with openly grooved, wing-margined, minutely punctate rachis and 9–14 (15) pairs of oblong-oblanceolate to -elliptic, obtuse but then abruptly sharply short-acuminate, dorsally keeled, mostly flat leaflets up to 5–10 mm long, the shortly stalked terminal one no larger than last pair, the spur-leaves smaller, with fewer (mostly 4–9) pairs of shorter

leaflets; *peduncles* 0–2 cm long; *spikes* very dense, the contiguous flowers horizontally spreading, the whole ovoid becoming cylindroid, without petals 8–10 mm diam, the glabrous or minutely puberulent axis 1.5–4.5 cm long; *bracts* deciduous only with the calyx and pod, subtended by spiculiform bracteoles up to 0.4–0.8 mm long, the lowest sometimes longer and firmer than the rest, lance-acuminate or -caudate, narrowly pallid-margined, otherwise green becoming brown or purplish, glabrous within and dorsally, minutely ciliolate; *calyx* 3.8–4.4 mm long, bluntly 10-angled, glabrous externally, the teeth densely pilosulous within and the orifice hence appearing ciliolate, the membranous, symmetrically campanulate tube scarcely recessed dorsally, 2.4–2.7 mm long, the thick but not prominent ribs becoming castaneous, the intervals narrow, castaneous-flecked with a narrow hyaline central panel, glandless, the teeth heteromorphic, the three dorsal ones triangular-lanceolate up to 1.3–1.7 mm long, the ventral pair almost as long but ovate-triangular, all firm, green becoming castaneous, the margins ± involute; *petals* lavender-purple, concolorous, glandless; *banner* 5.2–6 mm long, the claw 2.8–3.6 mm, the broadly ovate-suborbicular, strongly hooded blade shallowly cordate at base, 2.1–2.5 mm long, 2.6–3.2 mm wide; *episte-monous petals* 3–3.6 mm long, the linear-oblong obtuse blades slightly hooded at tip, cuneately narrowed at base into a claw 0.4–0.7 mm long; *androecium* 5.4–7.2 mm long, the column 2.6–3.7 mm, the free filaments 2.7–3.7 mm long, the connective gland-tipped, the anthers 0.6–0.85 mm, reddish, the pollen golden-orange; *pod* in profile half-obovate, 2.5–3 mm long, the ventral suture nearly straight to shallowly concave, the prow slender, the valves hyaline only at very base, thence papery, glabrous, minutely gland-sprinkled distally; *seed* pallid, ± 1.8–2 mm long; 2n = 14 (Mosquin). — Collections: 13 (o).

Notably bicentric in dispersal: limestone cedar glades and open calcareous barrens of centr. Tennessee, from Nashville Basin s. into n. Alabama (Franklin and Morgan counties; cf. Rhodora **69**: 383); and on thinly wooded bluffs and stony river-flats of upper Illinois River and its tributaries the Fox and Kankakee rivers in n.-e. Illinois (cf. Gamhill, Ill. Biol. Monogr. **22** (4): 47. 1953); cf. Wemple, 1970, map 4. — Flowering late June to September. — *Representative*: ILLINOIS: *Umbach 1896, 1995, 5715* (WIS); *Calkins,* from Ottowa, La Salle Co. (WIS). TENNESSEE: *Gattinger* distrib. *Curtiss 570* (NY); *Baskin s. n.* in 1966 (DAO, pods, NY); *Kral 29,001* (OKLA); *Isely & Wemple 9420* (NY). ALABAMA: *Baskin & Caudle 509, 517* (US).

Dalea foliosa (Gray) Barneby, comb. nov., based on *Petalostemon foliosus* (leafy) Gray, Proc. Amer. Acad. **7**: 336. 1867. — "Banks of Fox River, Kane Co., Illinois, Burgess Truesdale, 1867. Also near Nashville, Tennessee, Mr. Hatch, 1854." — Lectoholotypus, *Truesdale in 1867*, GH! isotypi, K, NY! paratypi, *Hatch in 1854*, GH, MO! — *Kuhniastera foliosa* (Gray) O. Kze., Rev. Gen. 192. 1891.

An unmistakable species, notable for its many pairs of leaflets, in this respect differing from all prairie-clovers east of the Mississippi. My concept is traditional and in full agreement with Wemple (1970, p. 51, fig. 10D). The bicentric range closely resembles that of *Astragalus tennesseensis* Gray (cf. Barneby, Mem. N. Y. Bot. Gard. **13**: 769, map 103), likewise taxonomically isolated, but seemingly a western element in the eastern flora. Plants grown from seed received from J. Baskin, collected at the southern edge of Nashville city, have proved fully frost-hardy on eastern Long Island, flowering profusely almost throughout summer and setting abundant seed. The ecology and dispersal of *D. foliosus* have been described in detail by Baskin & Baskin (Rhodora **75**: 132–139 + map. 1973) who regard it as a diminishing species, probably extinct in the northern lobe of its range and threatened in Tennessee.

41. DALEA CANDIDA Michaux ex Willdenow
(Plate LVI)

Herbaceous from an ultimately thick, tough taproot and knotty root-crown or short caudex situated at or just below soil-level, variable in stature (3–10 dm) and in habit of growth, the erect or diffuse, pale green or stramineous, prominently ribbed, glandless or minutely punctate stems simple or branched from near middle or only distally, the foliage either rich green or pallid-glaucescent, the leaflets smooth above, punctate beneath; *leaf-spurs* 0.2–1 mm long; *stipules* triangular-subulate to narrowly lanceolate, greenish becoming stramineous or brownish, sometimes minutely livid-glandular, (1) 1.5–5.5 mm long; *intrapetiolular glands* 0 or impressed and minute; *post-petiolular glands* either prominent or immersed; *leaves* subsessile or short-petioled, the main cauline ones (sometimes drought-deciduous) 1.5–6 cm long, with broadly margined, usually punctate rachis and 2–4 pairs of leaflets variable in size and outline, obovate to elliptic-oblanceolate or linear-oblong, either acute, short-acuminate, or emarginate, flat or loosely folded, up to 0.7–3.5 cm long, the terminal one either sessile or short-stalked, longer than the rest; *peduncles* in reality very short or 0, but leaves at 2–several nodes preceding the spike almost always reduced to stipuliform bracts, the stem hence leafless for 1–14 (20) cm distally and simulating a peduncle; *spikes* variable in density, cone- or ament-like, ovoid to cylindroid (a few sometimes subglobose), without petals 6–10 mm diam, the glabrous or minutely pilosulous axis 1–5.5 (7.5) cm long; *bracts* subdimorphic, the lowest firm, reflexed, persistent, the rest deciduous by anthesis (sometimes held fast between the calyces), greenish or livid-castaneous beyond the papery base, the body narrowly obovate to oblanceolate, contracted into a tail as or only half as long, all usually narrowly pallid-margined, minutely ciliolate, gland-sprinkled dorsally; *bracteolar spicules* (0.5) 0.6–1.6 mm long, minutely ciliolate; *calyx* (2.9) 3–4.2 (4.4) mm long, glabrous except for minutely ciliolate inner margin or inner face of teeth or, less commonly, the tube externally pilosulous with fine weak hairs less than 0.4 mm long, the subsymmetric tube 1.9–2.7 mm long, angular-pleated, not recessed behind banner, the prominent but slender ribs often castaneous, the firmly membranous intervals either pallid or castaneous-flecked, charged (nearly always) near the orifice with 1, less often 2–3, usually small transparent or yellow blister-glands, the firm, green or livid, ± connivent teeth somewhat unequal, the dorsal one longest and narrowest, lanceolate or narrowly triangular, 1–1.8 mm long, usually 0.6–1.4 mm shorter than tube, the ventral pair a little shorter, triangular to deltate; *petals* white, glandless; *banner* (4) 4.2–5.7 mm long, the filiform claw (1.9) 2.2–3.8 mm, the broadly deltate-obovate, obtuse or emarginate, hooded blade deeply cordate at base, 2.3–3.4 mm long, 2.4–3.7 (4.2) mm wide; *epistemonous petals* subhomomorphic, 3.2–5.2 mm long, the filiform claw (0.7) 0.9–2.3 mm, the oblong, oblong-oblanceolate, or elliptic-oval blade concave at the obtuse or subemarginate apex, 2–3.5 mm long, 1.3–2.1 mm wide; *androecium* (5) 5.2–7.6 mm long, the column 2.3–3.5 mm, the free filaments up to 2.5–4.5 mm long, the connective gland-tipped, anthers yellow, (0.7) 0.8–1.3 mm long; *pod* very obliquely half-obovate or obliquely clavate in profile, ordinarily exserted, (2.6) 2.8–4 (4.5) mm long, the ventral suture straight or slightly concave, the style-base excentrically terminal, the convex prow thickened and prominent, the valves hyaline at base, firm and sometimes thinly pilosulous distally, charged near or above middle with a crescent of usually contiguous and oblong, sometimes round and more scattered, pale or orange blister-glands; *seed* oblong-elliptic, ± 1.7–2.3 mm long.

The prototype of the white prairie-clovers and generitype of *Petalostemum*, a complex species of wide dispersal, closely related only to *D. multiflora*, which has essentially the same flower-structure but (at least ideally) more numerous, shorter flower-spikes combined with slightly more numerous leaflets. Despite evidence persuasively deployed by Isely & Welsh (1960), quoted and amplified by Wemple (1970, p. 46–7), I persist here in a comprehensive concept of *D. candida* wide enough to embrace the diverse forms referred by these authors to *Petalostemon occidentale*. My dissent is founded on no new data, but on reinterpretation of facts long known.

Summing up the case for recognition of *P. occidentale* at specific level, Wemple appeals to the use of "multiple" differential characters, reduced in the key to two: an elongating spike and a more prominently ribbed, usually pilosulous calyx. It later emerges, however, that the calyx may be glabrous, but then accompanied by fewer, ordinarily (but not reliably) smaller leaflets and a more diffuse habit of growth. The prominence of the calyx-ribs appear to me as a function of spike-density. When the calyces, as in genuine *P. candidum*, are closely compacted, their tubes assume from mutual pressure, not exerted in the case of the loosely spicate *P. occidentale,* a more bluntly pentagonal figure. If this is so, the multiple differences are reduced to one. In the middle prairie region *P. candidum* extends west into the treeless prairie zone only in the rich bottomlands along rivers, where it finds conditions similar to those encountered east of the Mississippi. In the same longitudes *P. occidentale* extends eastward from its centers of abundance only in xeric habitats such as river-bluffs and eroded badlands. The populations within this band of sympatry appear to behave as ecologically allopatric species, but remain morphologically distinct only if an assessment of the whole variation within each species is ignored. The vexing populations of *P. occidentale* from the northwestern prairies which resemble *P. candidum* either in glabrous calyces, or large leaflets, or both at once, are interpreted by Wemple as independent variations with no direct genetic contact with genuine *P. candidum*, and therefore somehow irrelevant to the taxonomic problem. Yet these very plants, which mimic *P. candidum* except for their looser flower-spike, or shorter stem, or both, obstinately suggest that there survives in the genetic resources of *P. occidentale* a rich potential in common with its eastern counterpart. No analysis, however sophisticated, can eliminate them from the record.

Key to the Varieties of *Dalea candida*

1. Spikes relatively lax or by full anthesis becoming so, the axis usually partly visible in pressed specimens; *leaflets* of primary cauline leaves relatively small, the largest on a given plant up to (6) 9–20 (24) mm long; *calyx-tube* commonly pubescent externally but not seldom glabrous; *stems* mostly diffuse but sometimes virgately ascending, 2.5–7 dm long; widespread over the plains w. of longitude 97° W from Alberta to s.-w. Manitoba, s. to w. Texas, s.-w. to s. Utah, Arizona, and along the Sierra Madre piedmont to n. Durango, at its e. border overlapping the range of the next but found in more xeric habitats, especially on river-bluffs.
   41a. var. *oligophylla*.
1. Spikes remaining dense and conelike, the axis permanently concealed by calyces; *leaflets* of primary cauline leaves relatively ample, the largest of a given plant up to (12) 15–35 mm long; *calyx-tube* glabrous externally; *stems* commonly virgate and 5–10 dm long; widespread around the Mississippi valley and w., especially along bottomlands, into the prairies to ± 100° W, from s. Canada to e. Texas, e. to Illinois, w. Kentucky, centr. Tennessee, and Alabama.
   41b. var. *candida*.

41a. DALEA CANDIDA Michaux ex Willdenow var. OLIGOPHYLLA (Torrey) Shinners (Plate LVI)

Variable in habit of growth, (2.5) 3–7 dm tall, the stems nearly always diffuse, weakly virgate-ascending, or decumbent and distally incurved, branched from the middle upward, only subterminally, or almost throughout, the inflorescence therefore simply corymbose to amply paniculate, rarely monocephalous, the foliage mostly pallid or glaucescent, the leaflets not usually strongly bicolored, but often of slightly darker or more yellowish green above; *stipules* 1.5–3 mm long, usually more slender-tipped than in var. *candida*; *primary cauline leaves* (1.5) 2–5 cm long, with either 5 or 7 leaflets varying in outline from obovate and emarginate to oblong and obtuse, lance-oblong or -elliptic and shortly acuminate (or merely gland-mucronate), the odd leaflet largest, up to (6) 9–20 (24) mm long; *spikes* 6–8 mm diam, the axis 1–5 (7.5) cm long; *interfloral bracts* 2.5–4 mm long; *calyx* either glabrous externally up to the internally pilosulous teeth or thinly minutely pilosulous from base upward, the intervals between the ribs charged at apex, on either side of the sinuses, with 1, 2, rarely 3 blister-glands; *epistemonous petals* 3.2–4.5 (4.7) mm long, the blades varying from elliptic to oblong or oblanceolate, either tapering or truncate basally, 2.3–3.1 mm long, (1.1) 1.2–2.6 mm wide; $2n = 14$, $n = 7_{II}$ (Mosquin). — Collections: 211 (vii).

Dry open places, in great variety of soils, entering many xeric plant-communities and many floristic provinces, in climax grassland mostly on breaks and stony or gravelly ridges and therefore not directly competing with sod-forming grasses, w.-ward from New Mexico descending into sandstone desert and ascending through pinyon-juniper woodland into yellow pine parklands, from ± 200 m (670 ft), in Iowa up to 1950 m (6500 ft) in Montana, to 2150–2250 m (7200–7500 ft) along the piedmont of the Front Range in Wyoming, Colorado, and Mesa de Maya in n. New Mexico, reaching 2400 m (8000 ft) on the White Mts. and Kaibab Plateau in Arizona, widely dispersed and locally common over the short-grass prairies from the South Saskatchewan in Alberta to the Assiniboine valley in s. Manitoba s., mostly w. of 97° W. to Red River in Oklahoma and trans-Pecos Texas, thence widespread over most of New Mexico into the canyonlands of the San Juan, Grand and Colorado rivers in s.-w. Colorado and s.-e. Utah, in Utah n. as far as San Rafael Swell in Emery County, and through the mountains and intermontane valleys of Arizona as far w. as the Kaibab and the Verde River, extending just into n.-e. Sonora, and discontinuously s. along the e. slope and piedmont of Sierra Madre Occidental to the sources of Rio Nazas in n.-w. Durango; in central United States e. on river-bluffs to the South Dakota-Minnesota boundary, to the Missouri bluffs in Iowa, to centr. Kansas, and e.-centr. Oklahoma; reportedly adventive on the Wisconsin bank of the upper Mississippi in Buffalo County; cf. Wemple, 1970, map 6. — Flowering late May onward, in summer-rainfall areas of s.-w. United States and n. Mexico continuing into late fall. — Citation of representative var. *oligophylla* from U. S. and Canada superfluous. MEXICO. SONORA: typus of *P. sonorae* (cf. infra). CHIHUAHUA: *Shreve 7971* (ARIZ, F); *Mexia 2621* (F, NY, UC); *Pringle 1216* (MEXU); *Ripley & Barneby 13,931* (NY). DURANGO: typus of *P. truncatus* (cf. infra).

Dalea candida Michaux ex Willdenow var. **oligophylla** (Torrey) Shinners, Spring Fl. Dallas-Ft. Worth 211. 1958, based on *Petalostemon gracile β oligophyllum* (with few leaflets) Torr. in Emory, Notes Mil. Reconn. 139. 1848. — "Valley of the Del Norte." — Holotypus, collected near Albuquerque, New Mexico, by Lt. Emory, Sept 28, 1846, NY (herb. Torr.)! — *Kuhnistera oligophylla* (Torr.) A. Heller, Bull. Torrey Club **23**: 122.

1896. *Petalostemon oligophyllus* (Torr.) Rydb., Mem. N. Y. Bot. Gard. **1** (Fl. Mont.): 237. 1900. *P. candidus* var. *oligophyllus* (Torr.) F. J. Hermann, Jour. Wash. Acad. Sci. **38**: 237. 1948. *Dalea oligophylla* (Torr.) Shinners, Field & Lab. **17**: 82. 1949.

Kuhnistera occidentalis (western) A. Heller ex Britton & Kearney, Trans. N. Y. Acad. Sci. **14**: 33. 1895 (Jan/Feb). — "This is the *Petalostemon candidus* var. *occidentalis* Gray, in Pringle's labels, but never described or published. Mrs. Hoyt, Ft. Apache; Wilcox, Ft. Huachuca." — Lectotypus, *Pringle 1216*, collected near Guerrero, Chihuahua, Sept 9, 1887, NY (2 sheets)! isotypi, F, GH! — *P. candidus* var. *occidentalis* Gray ex Britt. & Kearn., Trans. N. Y. Acad. Sci. **14**: 33. 1895, in syn., nom. nud. *Kuhnistera candida occidentalis* Rydb., Contrib. U. S. Nat. Herb. **3**: 154. 1895 (Sept 14), an original and independent proposition based in part on Gray's unpublished trinomial and *Pringle 1216*, best treated retroactively as an inadvertent comb. nov. *Petalostemon occidentale* (A. Hell.) Fern., Rhodora **39**: 28. 1937.

Kuhnistera candida diffusa (spreading, of the stems) Rydb., Fl. Neb. **21**: 59. 1895. — "Deuel County [Nebraska], *Rydberg 58*. — Holotypus to be sought at NEB; isotypus, NY!

Petalostemon truncatus (square-cut, of the epistemonous petals) Rydb., N. Amer. Fl. **24**: 124. 1920. — Type collected at Tepehuanes, Durango, June, 1906, *Edw. Palmer 284*..." — Holotypus, NY! isotypi, F, K. US!

Petalostemon sonorae (of Sonora) Rydb., N. Amer. Fl. **24**: 125. 1920 ("*Sonorae*"). — "Type collected at Rio de Santa Cruz, Sonora, June 25, 1855, *Schott* (Mex. Bound. Surv. *no. 241*, in part...)." — Holotypus, NY! isotypi, F, NY!

In everything but nomenclature and taxonomic rank my concept of var. *oligophylla* coincides with *Petalostemon occidentale* of Wemple's revision (1970, pp. 43–47, fig. 9B); it will be unnecessary to review the segregates or the synonymy. A note on the still unidentified *P. virgatum* Nees, very likely to be referred here, will be found in Appendix I. The var. *oligophylla* is introduced first in order under *D. candida* because it seems to constitute the major and more complex segment of its species, the var. *candida*, adapted to a more uniform environment, being interpreted as the derived form, much poorer in detectable biotypes. This, however, may be an illusion, for all other close kindred of *D. candida* have in common with it a compact flower-spike and dispersal on the Atlantic slope. It is worth remark that Wemple overstates at 6000+ ft the low elevational limit of var. *oligophylla* in New Mexico and Arizona. In the lower Rio Grande valley in New Mexico it descends to 4100 ft (1230 m), and in Arizona certainly to 4000, according to Kearney & Peebles to 3000 ft (900 m). The plants from higher and lower sites seem not to differ from each other or from the high- and low-level prairie forms, except in random and individual fashion. Some populations of var. *oligophylla* in Chihuahua have short and relatively dense spikes more or less corymbosely arranged. These suggest *D. multiflora*, but have the few leaflets of var. *oligophylla*. Other variation in the variety, implicit in the foregoing description, is discussed at length by Wemple and has been analyzed also by Isely & Welsh (1960).

41b. Dalea candida (Michaux) Willdenow var. candida
(Plate LVI)

Stems usually erect, virgate, (4) 5–10 dm tall, paniculately branched distally, or branched from near middle upward, the panicle then long and narrow, exceptionally monocephalous and then exceptionally slender; *stipules* narrowly lanceolate to broadly subulate, (1) 1.5–5.5 mm long; *primary cauline leaves* 3–6 cm long, with 2–4, most often 3 pairs of broadly to narrowly elliptic-oblanceolate, acute to shortly acuminate, less often obtuse (then gland-mucronulate) leaflets up to (1.2) 1.5–3.5 cm long, the foliage mostly deep green when fresh, the leaflets sometimes drying verdigris

above, pale beneath; *bracts* 3–5.5 mm long; *spikes* (6) 6.5–9.5 (10) mm diam, the glabrous or puberulent axis (1) 1.5–5.5 (7) cm long; *calyx* always glabrous except for ciliolate teeth, the intercostal panels of tube charged at apex with usually 1 small, sometimes inconspicuous gland; *epistemonous petals* 3.6–5.2 mm long, the blades varying from oblong to elliptic or oblanceolate, either truncate or cuneate at base, 2–2.9 mm long, 1.3–1.7 mm wide; 2n = 14 (2 counts, cited by Wemple, 1970, p. 12). — Collections: 124 (i).

Rich prairies, mostly below 450 m (1500 ft), of centr. United States and adjoining Canada, extending s. and s.-e. into open oak- or oak-pine-woodland, in hill-country of n.-w. Arkansas up to 630 m (2100 ft), widespread and locally common around the Mississippi embayment and the lower Missouri valley e. of 100° W, n. (and up to 650 m) to s. Saskatchewan, s. Manitoba, and adjoining Ontario, e. to Illinois, centr. Kentucky, centr. Tennessee, and s.-w. Alabama, w. interruptedly to the Gulf Coastal Plain in s.-e. Texas and inland to the longitude of Austin and Fort Worth, w. to centr. Oklahoma, centr. Kansas, and (following the Platte River up to 1020 m) interruptedly to w. Nebraska; cf. Wemple, 1970, map 7. — Flowering late-May to August, rarely again in fall. — Citation of representative var. *candida* superfluous.

Dalea candida (white-flowered) Michaux ex Willdenow, Sp. Pl. **3**: 1337. 1802. — Holotypus, presumably at B, not seen; isotypus cited under the next! — *Petalostemum candidum* Michaux, Fl. Bor.-Amer. **2**: 49. 1803, an independent proposition treated retroactively as an inadvertent new combination. — "in Tennassée et in regione Illinoensi." — "Prairies des Illinois", *Michaux*, P (herb. Michx.)! — *Psoralea candida* (Michx.) Poir. in Lamk., Encycl. Méth. **5**: 694. 1804. *Kuhniastera candida* (Michx.) O. Kze., Rev. Gen. 192. 1891.

As noted by Wemple (1970, p. 50), var. *candida* is much less variable than var. *oligophylla*, ordinarily characterized by the combination of ample, 7-foliolate primary leaves, tall virgate stems, and dense cylindric flower-spikes. The latter may be arranged in a few-headed corymbose panicle or, with development of several or many of the usually inhibited axillary branchlets, in a long narrow thyrse, the lateral spikes then smaller and shorter than the terminal ones.

The white prairie-clover seems to have been extremely common over the high-grass prairie region before arrival of the plough; nowadays it is seen most often along highways and railroads, or in the glade environment of the southeastern woodlands. The clear white flowers are fragrant and often besieged by butterflies, bees and various hymenoptera.

42. Dalea multiflora (Nuttall) Shinners
(Plate LV)

Closely related to *D. candida*, differing somewhat in habit of branching and leaflets; *stems* of adult plants several or numerous, mostly erect and ascending in clumps, 3–9 dm tall, either virgate and paniculately branched distally or branched nearly throughout, never monocephalous; *foliage* either deep or pallid green; *stipules* 0.4–2 mm long; *primary cauline leaves* 2–3 cm long, with 3–6, mostly 4 or 5 pairs of narrowly oblong to elliptic-oblanceolate, less often narrowly obovate or linear-oblong leaflets up to 7–13 mm long; *spikes* permanently dense, headlike, subglobose to shortly oblong, without petals 7–9 mm diam, the glabrous axis 4–10 (12) mm long, concealed by calyces; *calyx* of *D. candida*, always glabrous except for ciliolate teeth, the intercostal panels of tube charged at apex with 1 (2) glands; *epistemonous petals* 3.5–5

mm long, the oblong blades obtuse, usually truncate at base, 2.3–3.5 mm long, 1.5–2.1 mm wide. — Collections: 86 (i).

Prairies and stony hillsides, in great variety of xeric microhabitats, in acid sands, rich clays, and calcareous gravels, near sea-level on the Gulf Coast up to ± 660 m (2200 ft) on Edwards Plateau, widespread and locally common from the coastal prairies between Galveston and Corpus Christi, Texas, w. to lower Devils River in Sutton and Valverde counties, n. through central Oklahoma to e.-centr. Kansas and immediately adjacent w.-centr. Missouri (Jackson County); s. interruptedly and apparently rarely to centr. Coahuila and the n. extremity of Sierra Madre Oriental in Nuevo León; cf. Wemple, 1970, map 5. — Flowering (mid-May) June to September. — *Representative*: UNITED STATES. MISSOURI: *Bush 257, 826* (NY). KANSAS: *W. T. Barker 4349* (NY); *Bartley 1126, 1207* (NY); *McGregor 17,332* (NY). OKLAHOMA: *Hopkins & Cross 6447* (NY, OKLA, UC); *Waterfall 12,431* (OKLA, UC, WIS); *Demaree 13,275* (NY, UC). TEXAS: *Berlandier 2467* (GH, NY); *Wemple 242* (NY); *A. Heller 1814, 1903* (NY, UC); *Whitehouse 16,155* (NY, UC); *Cory 53,312* (NY, UC); *E. J. Palmer 13,585* (WIS). MEXICO. COAHUILA: *Marsh 30, 1311* (F, OKLA, TEX); *Wynd & Mueller 223* (ARIZ, NY). NUEVO LEÓN: *C. & M. Mueller 505* (F, MEXU, TEX).

Dalea multiflora (Nuttall) Shinners, Field & Lab. **17**: 82. 1949, based on *Petalostemon multiflorum* (many-flowered) Nutt., Jour. Acad. Philad. 7: 92. 1834. — "In the plains of Red river." — Holotypus, PH, verified by Wemple, 1970, p. 41; isotypi, labelled by Nuttall "*Petalostemon *multiflorum*. Red River", NY (herb. Torr.) and "Arkansa", probably = Choctaw County, Oklahoma, collected by Nuttall in May 1819, K! — *Kuhnistera multiflora* (Nutt.) A. Heller, Mem. Torrey Club **5**: 197. 1894. *K. candida multiflora* (Nutt.) Rydb., Contrib. U. S. Nat. Herb. **3**: 154. 1895.

Closely akin to *D. candida*, of which it has exactly the individual flower, but differing in the short, always compect spikes combined with relatively many leaflets. The spikes may be arranged either in a narrow thyrse at top of a tall virgate stem, or corymbosely at tips of all branchlets of a more diffuse and shorter primary axis. The plants vary much in stature, those of lowland prairies between Kansas and the Gulf coast resembling sympatric var. *candida*, whereas those of more arid hill-country of Edwards Plateau are lower and bushier. The range of the tall lowland ecotype of *D. multiflora* coincides extensively with that of var. *candida*, and occasional intermediate forms, with foliage of the first but cylindric spikes of calyces, are difficult to assign to either species. During my independent study of sect. *Kuhnistera* I interpreted these intermediate types as evidence of intergradation and, following an earlier estimate of Rydberg, annotated many sheets of *D. multiflora* as *D. candida* var. *multiflora* (nom. nud.). Wemple, however, has synthesized a hybrid *D. candida* × *multiflora* and finds the plants very similar to the naturally occurring intermediates, which may well be first-generation hybrids also. The lower ecotypes of *D. multiflora* are found in central Oklahoma to overlap the range of *D. candida* var. *oligophylla*, but from this region no intermediates are known as yet and the two entities become almost completely vicariant in range south of Red River. Occasionally the spike of var. *oligophylla* fails to lengthen much, even in fruit, and it then very closely resembles the spike of *D. multiflora*, but is generally then combined with substantially simpler stem-leaves that are the most stable diagnostic feature of var. *oligophylla*. I therefore follow Wemple in treating *D. multiflora* as specifically distinct.

According to Shinners (1949, p. 82) the androecium of *D. multiflora* is sometimes hexamerous, but I have seen no instance of this certainly anomalous condition. Wemple by a slip traces *D. multiflora* to Chihuahua; doubtless Coahuila is meant.

43. DALEA CARNEA (Michaux) Poiret
(Plate LVII)

Herbs, when adult sometimes suffrutescent at base, 3–8 (10) dm tall, glabrous except for minutely ciliolate bracts and internally tomentulose calyx-teeth, variable in habit of growth, the stems either relatively stout and erect or ascending in clumps, then virgate and paniculately branching distally, or bushy-branched from middle or near base, or diffuse to decumbent or truly prostrate, monocephalous only when depauperate, in any case either green or purple-castaneous, striate-ribbed, glandless or minutely remotely gland-sprinkled distally, the foliage green, the leaflets somewhat bicolored, smooth above, punctate and often brownish-green beneath; *leaf-spurs* 0.6–1.5 mm long; *stipules* subulate, linear-lanceolate, or setiform, becoming dry and fragile, 1–4.5 mm long; *intrapetiolular glands* minute or 0; *post-petiolular glands* immersed or if prominulous small; *leaves* subsessile or shortly petioled, the primary cauline ones 1.5–3.5 cm long, with narrowly margined, usually punctate rachis and 5–9 elliptic or oblanceolate, acute or if obtuse then gland-mucronate, or abruptly short-acuminate, either flat but marginally elevated or more often boat-shaped, incurved, dorsally keeled leaflets up to (5) 6–17 mm long, the largest at least 1 mm wide when expanded (or 0.5 mm as seen in profile), the very short-stalked or subsessile terminal one not or scarcely longer than the last pair; *peduncles* 0 or nearly so, but some distal leaves commonly reduced to a stipuliform bract and the stem then naked under the spike for 2–8 (13) cm; *spikes* very dense, conelike, the mature calyces mostly horizontal to the axis, the lowest declined, without petals ovoid-oblong becoming oblong-cylindroid or subglobose, 7–10 mm diam, up to 5–30 mm long, the first of each main stem commonly longer than those of lateral branchlets; *bracts* deciduous only with the fruit, subhomomorphic or the lowest firmer, longer and more persistent than the rest, lanceolate or lance-acuminate, (2) 2.5–5.5 mm long, ± 1 mm shorter to 1 mm longer than the subtended calyx, purplish or brownish except at very base, often charged dorsally with a few tiny glands; *calyx* subtended by bracteolar spicules 0.6–1.5 mm long, 2.7–4.3 mm long, bluntly angled but not or inconspicuously ribbed, the rather narrowly campanulate tube 2–3.2 mm long, often a trifle constricted near orifice, this deeply recessed behind banner, the intervals between the immersed castaneous ribs heavily castaneous-flecked glandless or charged distally with 1–3 small colorless glands, the teeth of nearly equal length, 0.6–1.5 mm long and ½–⅓ as long as tube, all subulate or the ventral pair ovate-subulate, all densely but minutely pilosulous internally, externally livid or greenish-livid in contrast to the (dry) pinkish-brown tube; *petals* white, flesh-pink, or rose-lilac, glandless or the banner exceptionally charged at base of blade with 2 minute glands; *banner* 3.8–5.7 mm long, the blade and claw of ± equal length, the former scoop-shaped, i. e. ovate, broadly cuneate at base, entire or emarginate at the strongly hooded apex; *epistemonous petals* 2.3–4.5 mm long, the blades oblong, oblanceolate, or oblong-elliptic, either abruptly truncate or cuneately tapering at base, the claw varying from ½ as to nearly as long; *androecium* 5–9.5 mm long, the column 1.7–4 mm, the free filaments up to (2.2) 2.5–6 mm long, the connective gland-tipped, the pallid anthers 0.6–0.85 mm long; *pod* 2.5–3 mm long, obliquely clavate-obovate in profile, strongly incurved, the ventral suture short and thick, the dorsal one very strongly convex, the prow heavily thickened and prominent (0.25–0.4 mm thick), the style-base subterminal or appearing lateral, the valves thinly papery (scarcely hyaline) at base, from middle livid, wrinkled, ± glandular, commonly pilosulous at apex like the style, sometimes glabrous.

A complex, polymorphic species of wide dispersal on the Gulf and Atlantic Coastal plains from extreme southeastern Louisiana to Georgia and south to the Everglades, related to the allopatric (more northern and western) *D. candida*, but differing in the almost terete (not pleated) calyx asymmetrically cleft behind the banner and in the shape of the little scoop-shaped, not heart-shaped banner-blade. The more nearly related and sympatric *D. feayi* of peninsular Florida is distinguished from pink-flowered *D. carnea* var. *carnea* by its extremely narrow leaflets combined with few-flowered globular spikes. The only other prairie-clover present in the range of *D. carnea* is *D. pinnata*, entirely different in its long-toothed plumose calyces compressed into a head subtended by several whorls of purple-brown bracts.

My concept of *D. carnea* sens lat. coincides with *Petalostemon carneum, albidum*, and *gracile* of Wemple's revision (1970, pp. 31–36); most of the material that I have seen was studied also by Wemple and we have no substantial disagreement as to the scope of the three entities, only as to their nature and taxonomic rank. My interpretation of the material is that it represents a virtually continuous series of variants which have developed marked morphological differences toward three extremities of a continuous range, these differences apparently encouraged by adaptation to selective microhabitats. Wemple develops the theory that there are two older species, *P. carneum* of peninsular Florida and *P. gracile* of the Gulf Coast prairie, both native in undisturbed lowlands moist in the wet summer season, and *P. albidum* which arose through hybridization between the primary species and, adapting to a drier regime in the disturbed woodlands of interior northern Florida, has thence moved northward as an autonomous entity into Georgia. Continuing studies by Wemple may well substantiate this hypothesis but for the present the views expressed here seem equally rational. The extreme forms of *D. carnea* are readily recognized: at one end typical var. *carnea*, with mostly erect, coarse, erect but either virgate or bushy-branched stems densely leafy with spurs in all primary axils, and oblong to cylindric spikes of relatively large pink flowers; at the other end var. *gracilis*, with flexuously procumbent, very slender, sparsely and remotely leafy stems mostly lacking axillary short-shoots, and with shortly oblong to subglobose spikes of small white flowers. These are fully allopatric, so far as known, but almost converge near the lower Suwanee River in northern Florida. Difficulty arises only with var. *albida*, dispersed across northern Florida, north into Georgia, and overlapping to some degree the ranges of the other two. In habit var. *albida* varies from erect to diffuse and from moderately robust to almost the equal of var. *gracilis* for slenderness; and its heads of white flowers are intermediate in overall size and in dimensions of the parts. The inner petals of var. *gracilis* and var. *albida* tend to have claws relatively longer than those of var. *carnea*, but this is a variable feature, and it cannot be over-emphasized that there is no structural difference in the flowers.

Key to the Varieties of *Dalea carnea*

1. Stems mostly erect and ascending in clumps, only rarely diffuse or trailing; *leafy short-shoots* present in most primary axils, the stems appearing densely leafy; *flowers* variable in size, the calyx 2.9–4.3 mm long, the petals either white or pink; *androecium* mostly 6–9.5 mm long; central Georgia s. through Florida to the Everglades, w. in Florida to Tallahassee and also just into extreme e. Alabama.
   2. Petals pink or flesh-pink (exceptionally white, but calyx then large); *leaflets* of primary leaves 7–9; *calyx* 3.2–4.2 mm, its teeth 0.9–1.5 mm long; extreme s.-e. Georgia s.-ward. 43a. var. *carnea*.
   2. Petals white; *leaflets* of primary leaves mostly 5; *calyx* 2.9–3.5 mm, its teeth 0.6–1.1 mm long; n. Florida n.-ward. 43b. var. *albida*.

1. Stems very slender (especially at base) diffuse or procumbent; *leafy axillary short-shoots* mostly suppressed or rudimentary, the stems hence remotely leafy (leaves mostly 7-foliolate); *flowers* small, the calyx 2.7–3.3 mm, its teeth 0.6–0.9 (1.1) mm long (petals white); *androecium* ± 5–6 mm long; Gulf Coastal Plain w.-ward from extreme s.-w. Georgia and adjoining Florida to s.-e. Louisiana. 43c. var. *gracilis*.

43a. Dalea carnea (Michaux) Poiret var. carnea
(Plate LVII)

Stems normally erect-ascending, herbaceous or (s.-ward) feebly suffrutescent (3) 4–8 (10) dm tall, either virgate and paniculately branched distally or bushily branched from middle or base; *leaves* crowded along the stem, the primary ones all subtending spurs, 1.5–3.5 cm long, the (5) 7 or 9 leaflets up to (5) 6–13 mm long; *spikes* (7) 8–10 mm diam, the axis of central ones 1–3 (3.5) cm long; *bracts* 2.5–5.5 mm long; *calyx* 3.2–4.3 mm, the tube (2.1) 2.3–3 (3.2) mm, the dorsal tooth 0.9–1.5 mm long; *petals* pale flesh-pink to bright lilac-pink, exceptionally white; *banner* 4.2–5.7 mm, the blade 2.5–3 mm long, 1.7–2.4 mm wdie; *epistemonous petals* (3) 3.3–4.5 mm, the claw 0.7–1.2 mm, the blade 2.3–3.3 mm long, 0.7–1.1 mm wide; *androecium* (5.5) 6–9.5 mm, the free filaments 3–6 mm long; 2n = 14 (Wemple, 1970, p. 12), n = 7_{II} (Mosquin). — Collections: 41 (o, sed v.v.).

Pine barrens, hammocks, flatwoods, mostly in low, seasonally moist land with palmetto, sometimes on dry upland sands, widespread and locally common almost throughout peninsular Florida, n.-w. on the Gulf side to Taylor County, and on the Atlantic side crossing St. Mary's River just into Charlton County, Georgia; cf. Wemple, 1970, map 3. — Flowering June to December, in frostless areas throughout the year. — *Representative*: Georgia: *Harper 1493* (NY). Florida: *Curtiss 567*, 4225* (NY, UC); *Kral 7815, 7924* (NY); *Small 8341* (albino, NY); *Small & Carter 1205* (NY); *Isely & Wemple 9230, 9308, 9372* (NY).

Dalea carnea (Michaux) Poiret, Dict. Sci. Nat. **13**: 462. 1818, based on *Psoralea carnea* (Michaux) Poiret in Lamarck, Encycl. Méth. **5**: 694. 1804, based in turn on *Petalostemum carneum* (flesh-pink, of the petals) Michx., Fl. Bor. Amer. **2**: 49. 1803. — Holotypus, labelled "Lieux humides près Nord West riv. en Floride", P (herb. Michx.)! — *Kuhniastera carnea* (Michx.) O. Kze., Rev. Gen. 192. 1891.

Petalostemon roseum (pink) Nuttall, Amer. Jour. Sci. **5**: 298. 1822. — "...in East-Florida, during the months of October and November, 1821. By A. Ware, Esq." — Holotypus, verified at GH by Wemple (1970, p. 35), not seen. — *Kuhniastera rosea* (Nutt.) O. Kze., Rev. Gen. 192. 1891.

Southward from Levy and Marion counties (the latitude of Daytona Beach) var. *carnea* is the only prairie-clover of its group (other than the sharply distinct *D. feayi*) of which I have seen actual specimens. Wemple (1970) traces var. *albida* south to Lee County and has annotated one sheet from there (*Small 8341*) as *P. albidum*, but I believe this is merely an albino variant of var. *carnea*, of which it has the large calyx. North from the line mentioned var. *carnea* and var. *albida* are sympatric, though the former is found mostly in lowlands near the coast, the latter in drier upland conditions in the interior. In this region there are ambiguous populations difficult to assign to either and others intermediate between var. *albida* and var. *gracilis*.

43b. DALEA CARNEA (Michaux) Poiret var. ALBIDA (Torrey & Gray) Barneby (Plate LVII)

Variable in habit and vigor, the stems mostly 4–8 (10) dm long, erect and virgate-paniculate to diffuse-decumbent; *primary leaves* 1.5–4 cm long, mostly 5-foliolate, with longer petiole than var. *carnea* and the terminal leaflet often much longer than the rest; *spikes* 0.7–2 cm long, 7–9 mm diam; *calyx* 2.9–3.5 mm, its tube 2.1–2.4 mm, and teeth 0.6–1.1 mm long; *petals* as var. *carnea* but white, sometimes a trifle smaller; 2n = 14 (Wemple, 1970, p. 12). — Collections: 22 (o).

Sandy pine-oak woodlands, apparently avoiding the moist lowlands where var. *carnea* is commonest, widespread in n. peninsular Florida and n. inland from the immediate coast into central Georgia and (acc. Wemple) extreme s.-e. Alabama; cf. Wemple, 1970, map 2. — Flowering July to November. — *Representative*: GEORGIA: *Harper 433, 873, 1781* (NY); *Kuns 183* (WIS). FLORIDA: *Curtiss 4224, 5200* (NY, UC), *5880* (UC); *Small et al. 10,584* (NY); *Isely & Wemple 9238, 9263* (NY).

Dalea carnea (Michaux) Poiret var. **albida** (Torrey & Gray) Barneby, comb. nov., based on *Petalostemon carneum β albidum* (whitish, of the petals) T. & G., Fl. N. Amer. **1**: 311. 1838. — "...near Milledgeville [Baldwin Co], Georgia, *Dr. Boykin.*" — Holotypus, NY (herb. Torr.)! — *Petalostemon albidus* (T. & G.) Small, Fl. S. E. U. S. 1332. 1903.

In many respects var. *albida* is morphologically intermediate vetween var. *carnea* and var. *gracilis* and in northern Florida occurs in the geographical hiatus between them. Wemple suggests that it may represent a genetic recombination of two older types, but one that may have occurred in the distant past, for var. *albida* now has an extensive independent range. The leaflets of main cauline leaves are in var. *gracilis* mostly seven with the odd one longest; in var. *carnea* seven or nine but the odd one scarcely longer; in var. *albida* only *five*, with a long odd one as in var. *gracilis*. In this respect var. *albida* is not strictly intermediate between the supposed progenitors but appears to have drifted off in an independent course of modification such as one would reasonably expect of a geographic subspecies.

Wemple's map shows *P. albidus* extending south in Florida to Lee County, but there are only two dots from south of the latitude of Daytona, one of which (as mentioned under var. *carnea*) is based on a misidentification. In northern Florida var. *albida* has been traced west on the Gulf Coast to Franklin County, where it comes out to the coast near Carrabelle, at or close to the east limit var. *gracilis*. The most northern record in Georgia is still the original one of Boykin at Milledgeville.

43c. DALEA CARNEA (Michaux) Poiret var. GRACILIS (Nuttall) Barneby (Plate LVII)

Stems slender, flexuously diffuse or prostrate, 3–7 dm long, few-branched distally, often without axillary leafy spurs and thus appearing sparsely leafy, but spurs sometimes weakly developed and always present as primordia; *primary leaves* 2–3.5 cm long, with usually 7 leaflets up to 7–17 mm long, the odd one obviously longest; *spikes* shortly oblong to subglobose, 7–8 mm diam, 0.5–1.5 cm long; *bracts* 2–2.5 mm long; *calyx* 2.7–3.3 mm, its tube 2–2.5 mm, the teeth up to 0.6–0.9 (1) mm long; *petals* white; *banner* 3.8–4.5 mm, its blade 1.8–2.5 mm long, 1.4–2 mm wide; *epistemonous petals* ± 3 mm, the claw 1–1.7 mm, the blade 1.7–2.3 mm long, 0.7–1

mm wide; *androecium* 5–6 mm, the free filaments 2.7–3.3 mm long; 2n = 14 (Wemple, 1970, p. 12). — Collections: 12 (o).

Seasonally moist savannahs in the pine belt of the Gulf Coastal Plain, local, extending only a short way inland, s. Mississippi, s.-e. Alabama, and the Florida Panhandle, according to Wemple (1970, map 2, but not in text) extending to the n. shore of Lake Pontchartrain in extreme s.-e. Louisiana and up Flint River into the s.-w. corner of Georgia, w. in Florida into Wakulla County. — Flowering August–September. — *Representative*: MISSISSIPPI: *Isely & Wemple 9110* (NY); *Jacob 10* (OKLA). ALABAMA: *Pennell 4450* (NY); *Lloyd & Tracy 153* (NY). FLORIDA: *Biltmore Herb. 3040* (NY, US).

Dalea carnea (Michaux) Poiret var. **gracilis** (Nuttall) Barneby, stat. nov., based on *Petalostemon gracile* (slender) Nutt., Jour. Acad. Philad. 7: 92. 1834. — "*Hab.* In the lower parts of Alabama and Florida." — Holotypus, PH (not seen, but verified by Wemple, 1970, p. 33); isotypi, GH, K, NY (herb. Torr.)! — *Kuhniastera gracilis* (Nutt.) O. Kze., Rev. Gen. 192. 1891.

Petalostemon bicolor (bicolored, presumably of the calyx) Bertoloni, Mem. Accad. Bologna **2**: 273, tab. 13, fig. 1 (= Miscell. Bot. **9**: 9, pl. 3, fig. 1). 1850. — "Alabama", collected presumably by Dr. Gates. — Holotypus, ? BOLO, or probably destroyed; probable isotypus, labelled "Alabama, *Gates*", NY (herb. Torr.)!

Easily recognized in its typical extreme form by the slender diffuse habit, suppression of most axillary short-shoots and resultant sparse foliage, and the short heads of small white flowers. These characters appear singly or in pairs in some populations of var. *albida* from as far east as Jacksonville, but not together outside the Florida Panhandle. Wemple points out that var. *gracilis*, because of its less complicated branching, has a shorter flowering season than other forms of *D. carnea*.

44. DALEA FEAYI (Chapman) Barneby
(Plate LVII)

Perennial from orange roots, at first herbaceous becoming suffruticose, 3–7 dm tall, when adult becoming a diffuse or hemispherical bush up to 1 m diam, glabrous except for minutely pilosulous spike-axis and tomentulose orifice of calyx, freely branching from the caudex upward, the old stems ± furrowed, the young ones stramineous often orange- or purple-tinged, minutely remotely microglandular, striate but not angular, going out into a few-headed panicle of subglobose heads, the copious but narrow and lacy foliage green, the leaflets smooth above, punctate beneath; *leaf-spurs* 0.2–1 mm long; *stipules* subulate or linear-lanceolate, livid, subglandular, becoming dry and fragile, 0.7–2 (2.5) mm long; *intrapetiolular glands* minute or 0; *post-petiolular glands* small, immersed or almost so; *leaves* short-petioled, the primary cauline ones 1.5–3.5 cm long, with narrowly thick-margined rachis and 7 or 9 rather distant, narrowly linear or vermiform, obtuse, sometimes gland-mucronulate, loosely folded to tightly involute, often arched leaflets up to (6) 7–12 (14) mm long, the terminal one almost sessile, longer than last pair, the leaflets of spur-leaves similar but smaller and mostly 3 or 5; *peduncles* truly 0 or very short, but the uppermost leaves often reduced to stipules or to a bract, the heads then raised well above functional leaves; *spikes* capitate, subglobose, without petals 7–9 mm diam, the lower calyces declined, the middle ones spreading, the uppermost ascending; *bracts* subtended by gland-spicules up to 0.6–1.2 mm long, subhomomorphic, ovate to broadly

lanceolate, 0.8–2 mm long, firm, livid, subglandular, the small lowest ones persistent, deflexed, the inner tardily deciduous with the fruit; *calyx* oblong-spindle-shaped, bluntly angled, 3.2–4.4 mm long, glabrous externally, the tube 2.5–3.4 mm long, deeply recessed behind banner, the ribs obscure, the intervals heavily castaneous-flecked, charged distally with 1–3 small blister-glands, the teeth of nearly equal length, the 3 dorsal subulate, the ventral pair ovate, all green externally, tomentulose within; *petals* pink, rarely lavender or white, concolorous, glandless; *banner* 4.4–5.2 mm long, the broad, flattened claw 2–2.6 mm long, the scoop-shaped, strongly hooded blade truncate to very broadly cuneate or shallowly cordate at base, emarginate at apex, 2.1–2.6 mm long, 1.8–2.5 mm wide; *epistemonous petals* 3.6–4.6 mm long, the oblanceolate to narrowly obovate, obtuse, apically hooded blades 2.6–3.5 mm long, contracted into a claw 0.9–1.7 mm long; *androecium* 6.5–9.2 mm long, the column 3–4.8 mm, the free filaments 3.5–5 mm long, the connective gland-tipped, the orange anthers ± 0.8 mm long; *pod* obliquely clavate-obovate in profile, 3–3.3 mm long, the short thick ventral suture shorter than the pod, the style-base lateral, the prow thickened, broadly rounded, the valves glabrous below the pilosulous style, at base pallid, thence livid, lustrous, wrinkled; *seeds* (little known) up to 2.2 mm long; 2n = 14 (Wemple, 1970, p. 12). — Collections: 21 (o, sed pluries v.v.).

Scrub barrens, open pinewoods, characteristically on sterile white sand, locally abundant in centr. peninsular Florida from Lake Okeechobee n. to Marion County, apparently disjunctly in w. Florida where coming out to the Gulf shore in Franklin County; somewhat isolated on Altamaha River in s.-e. Georgia (Long County); cf. Wemple, 1970, map 3. — Flowering June to October and (s.-ward) intermittently through winter and spring. — *Representative*: GEORGIA: *Harper 1995* (NY). FLORIDA: *Godfrey et al. 53,463* (NY); *Kral 7676* (NY); *Nash 1523, 1524* (NY, UC); *Curtiss 6699* (NY, UC); *Moldenke 5360* (NY); *Isely & Wemple 9316, 9330* (NY).

Dalea feayi (Chapman) Barneby, comb. nov., based on *Petalostemon feayi* (William T. Feay, ± 1803–1879) Chapman, F. S. U.S., ed. 2, 615. 1884. — "Bartow, South Florida (*Feay*)." — Holotypus, labelled "Florida, Feay", US (hb. Chapman.)! isotypi, GH, NY (herb. Canby.)! — *Kuhnistera feayi* (Chapm.) Nash, Bull. Torrey Club **22**: 149. 1895.

An elegantly delightful, almost ever-blooming bushy herb, notable for its extremely narrow leaflets and small subglobose heads of rose-pink, less often lavender, exceptionally white flowers. Its relationship, as perceived by Rydberg (1920, p. 124) and by Wemple (1970, p. 36, fig. 9D) is certainly with *D. carnea* sens. lat., but this cannot be extremely close for *D. feayi* occurs within the range of each of the major races of *D. carnea* without sign of hybridization. Most forms of *D. carnea* are found in a less specialized habitat, in the flat pinewoods and palmetto scrubland that is seasonally moist or inundated. The adaptation of *D. feayi* to the severe xerophytic regime of the white sandhills, where it is associated with *Ceriatiola, Polygonella,* and *Conradina*, all modified to resist periods of desiccation without injury, may well be a determinant of its discontinuous range.

IIIC (iv). Series PURPUREAE (Rydberg) Barneby

Strong perennials, either glabrous below the spikes or variably, sometimes canescently pilose throughout, the stems (whether branched or simple) with well-developed axillary short-shoots or leaf-fascicles; leaflets mostly 1–4, in *D. villosa* 5–8 (10) pairs, usually narrowly oblanceolate or linear; *bracteoles* minute or 0; *spikes* either cone-like or becoming loose and ament-like; calyx externally pilosulous all over, or pilosulous in lines and glabrescent between these, or softly long-pilose, the tube usually

symmetrical, the orifice recessed adaxially in *D. villosa*, the ventral pair of teeth ovate; *petals* usually vivid purple, sometimes rose-pink, exceptionally white. — Spp. 7, of wide dispersal over United States between the Appalachians and the Rocky Mountains, 2 n. over the plains to s. Canada, 1 w. to Rio Grande in New Mexico, all but 1 occurring in and 2 endemic to parts of Texas.

Dalea sect. **Kuhnistera** ser. **Purpureae** (Rydberg) Barneby, stat. nov., based on *Petalostemon* X. *Purpurei* Rydb., N. Amer. Fl. **24**: 121, 122, in clave. 1920. — Sp. lectotypica: *P. purpureus* (Vent.) Rydb. = **Dalea purpurea** Vent. — *Petalostemon* H. *Purpurei* Wemple, Iowa State Jour. Sci. **45** (1): 72. 1970.

Petalostemon IX. *Villosi* Rydb., N. Amer. Fl. **24**: 121, 122, in clave. 1920. Sp. lectotypica: *P. villosus* Nutt. = **Dalea villosa** (Nutt.) Spreng. — *Petalostemon* F. *Villosi* Wemple, Iowa State Jour. Sci. **45** (1): 58. 1970.

A critical group of rather uniform appearance, characterized by usually few pairs of narrowly lanceolate ot involutely linear leaflets, profuse axillary foliage, and vivid purple petals. The species have been much studied lately, and general agreement has been reached over the scope and genuine differential characters of the entities, though not necessarily over their taxonomic status or nomenclature. Except that I include the somewhat aberrant *D. villosa,* my concept of ser. *Purpureae* is consubstantial with the homonymous group of *Petalostemon* as defined by Wemple. The distinctive features of *D. villosa* in the context of ser. *Purpureae* are the more numerous (mostly 5–8, not 1–4) pairs of leaflets in the primary leaves, a copious, long and soft pubescence, an eventually loose spike, and a calyx recessed behind the banner. However, *D. reverchoni* has a spike as loose or looser at maturity, *D. tenuifolia* an equally long-pilose calyx, and some forms of *D. purpurea* itself softly gray-pilose stems and foliage; only the many leaflets and oblique calyx are unique to *D. villosa*, differential characters not held significant at the serial level in the cases of, respectively, *D. phleoides* or ser. *Compactae*. During his biosystematic study of the group Wemple found a high degree of interfertility between most members of his ser. *Purpurei* sens. str., but no compatibility between any of these and *D. villosa.* This, of course, emphasizes the somewhat detached nature of *D. villosa*, already appreciated by Rydberg.

While following Wemple almost to the letter in the delimitation of entities within ser. *Purpureae*, I take a broader view of specific limits. As a result, three species of *Petalostemon* are here reduced, in *Dalea*, to varietal status: *P. griseum* to *D. villosa* var. *grisea*; *P. pulcherrimum* to *D. compacta* var. *pubescens*; and *P. arenicola* to *D. purpurea* var. *arenicola*.

Key to the Species of Ser. *Purpureae*

1. Leaflets of primary cauline leaves 5–8 (10) pairs, the odd leaflet smallest, the foliage villous-pilose throughout; *stems* pilose with vertical or subretrorse hairs; *calyx-tube* pleated, and recessed behind banner; *spikes* loose, the calyces not concealing the axis after anthesis; psammophytic. 45. *D. villosa* (p. 258)
1. Leaflets 1–4 (5) pairs, the odd leaflet usually longer than the last pair, the foliage rarely villous-pilose throughout, the calyx-tube then neither pleated nor recessed behind banner; *spikes* either loose or conelike, but if loose the plant avoiding dunes and loose sands.
   2. Spikes relatively loose, not conelike, the few-ranked flowers after anthesis revealing part of the axis, at least in pressed specimens; *calyx-teeth* mostly as long or nearly as long as tube.

3. Calyx densely pilose, the longer hairs up to (0.7) 0.9–1.5 mm long; species of the High Plains (w. Texas and n. New Mexico, w. Kansas and adjacent Colorado; *stems* densely pilosulous at base, often glabrescent distally. 51. *D. tenuifolia* (p. 274)
3. Calyx pilosulous with shorter hairs; rare and local species, either of e.-centr. Texas or of centr. Tennessee and environs; *stems* either uniformly pilosulous throughout or glabrous at base.
   4. Calyx indistinctly 10-ribbed; *stems* glabrous or thinly pilosulous distally; *leaflets* of primary cauline leaves 5 or 7; cedar-glades of middle Tennessee to adjoining Georgia and Alabama. 50. *D. gattingeri* (p. 273)
   4. Calyx pentagonal, the ribs leading to the sinuses thickened and prominent; *stems* gray-pilose, contrasting with glabrous foliage; *leaflets* of primary cauline leaves 7 and 9 (11); very local in n.-centr. Texas. 49. *D. reverchoni* (p. 271)

2. Spikes permanently dense and conelike, the flowers (even when pressed) concealing the axis. One very widely dispersed and two mostly Texan species.
   5. Pubescence of calyx antrorsely ascending.
      6. Calyx 3.2–4.5 (5) mm long, the tube 1.7–2.8 (2.9) mm, the dorsal tooth (1.3) 1.5–2 (2.1) mm long, commonly pubescent equably from base to summit, but the teeth (especially s.-ward) sometimes glabrescent dorsally, the hairs on their margins then mostly over 0.25 mm long; *spikes* 7–12 mm diam, mostly not over 10 mm diam in or near range of the next; s. Canada to n. New Mexico, n.-w. and centr. Texas, Alabama, and lower Ohio valley, the common purple prairie-clover of the Prairie United States. 46. *D. purpurea* (p. 262)
      6. Calyx (4.4) 5–6.2 mm long, the tube 3–3.8 mm, the longest tooth (1.2) 1.4–2.4 mm long, pubescent only on margins of teeth and in vertical lines running to sinuses between teeth, the pubescence plushlike, composed of crowded hairs up to 0.1–0.25 mm long, the teeth dorsally, either at base or their whole length, glabrous and greenish-glaucescent; *spikes* 10.5–14 (15) mm diam; e. and e.-centr. Texas to s.-e. Oklahoma and adjoining Arkansas and Louisiana. 47. *D. compacta* (p. 267)
   5. Pubescence of calyx (otherwise like that of *D. compacta*) of two sorts, that of the tube retrorsely descending, that of the teeth plushlike and antrorsely ascending; Edwards Plateau and related calcareous hill-country of centr. Texas. 48. *D. tenuis* (p. 270)

45. DALEA VILLOSA (Nuttall) Sprengel
(Plate LVI)

Relatively coarse, densely leafy perennial herbs from long, thonglike orange roots, 2–8 (9) dm tall, the erect, incurved-ascending, or diffuse stems greenish or castaneous, ribbed, glandless or almost so, nearly always paniculately branched just (sometimes well) below the central structurally terminal spike, the branches going out into usually smaller spikes, densely villous or villous-tomentulose throughout with fine weak spiral hairs, these on the stem subvertical or slightly retrorse and up to 0.8–1.5 mm (often mixed with shorter, sinuous ones), those on the leaves hardly shorter but loosely ascending to subappressed, the inflorescences likewise densely pilosulous, the foliage

greenish-gray to silvery-canescent, the leaflets not or scarcely bicolored, smooth beneath the vesture above, livid-punctate beneath; *leaf-spurs* 0–1 mm long; *stipules* linear-caudate or setiform, early dry and fragile, (1.2) 2–6 (7) mm long, commonly livid; *intrapetiolular glands* 2, minute; *post-petiolular glands* small but prominent, blunt; *leaves* short-petioled or subsessile, the primary cauline ones 2–4 (4.5) cm long, with narrowly margined rachis and (4) 5–8 (10) pairs of elliptic to elliptic-oblanceolate, obtuse and gland-mucronate or acute to short-acuminate, shallowly boat-shaped to loosely folded, dorsally keeled leaflets up to 5–14 (15) mm long, the terminal leaflet short-stalked but *smaller* than at least some of the lower pairs, the leaves of spurs present in most axils similar but smaller, with mostly 3–5 pairs of shorter leaflets; *peduncles* 0–1 (2.5) cm long; *spikes* moderately dense but not conelike, becoming narrowly oblong-cylindric, without petals 7–10 mm diam, the flowers (pressed) appearing ± 3-ranked, the long central (rarely solitary) spike becoming 3–12 (14) cm long, when very long often sinuous or drooping, the lateral ones shorter; *bracts* deciduous by full anthesis, linear-lanceolate or caudate, (1.5) 2–5.5 mm long, papery, castaneous, dorsally pilosulous up to or almost to the livid sectaceous tip, this commonly but not always surpassing the buds; *calyx* 2.8–3.8 mm long, densely pilosulous externally with spreading hairs up to 0.7–1.2 mm long or the tube sometimes more shortly hairy, the ribbed and pleated tube 1.9–2.7 mm long, recessed behind banner, the intercostal panels not strongly differentiated in texture, heavily castaneous-flecked, the teeth of ± equal length but dissimilar in form, up to 0.8–1.3 mm long, the 3 dorsal ones lanceolate or subulate, the central pair ovate or deltate, all gland-tipped and sometimes minutely gland-spurred marginally; *petals* rose-purple, pale pink, or rarely whitish, glandless; *banner* 4.4–5.6 mm long, the claw 2.1–3 mm, the ovate blade broadly cuneate to truncate or obscurely cordate at base, hooded at apex, 2.3–3 mm long, 2–2.6 mm wide; *epistemonous petals* 2.6–4.5 mm long, the oblong-oblanceolate, truncate or obtuse, apically concave blades 2.1–3.8 mm long, 0.9–1.3 mm wide, cuneately contracted into a claw 0.4–0.7 mm long; *androecium* (5) 5.4–7 mm long, the column 2.2–3 mm, the filaments free for 2.5–4.4 mm, the connective gland-tipped, the yellow or orange-yellow anthers 0.65–0.9 (1) mm long; *pod* 2.5–3.2 mm long, in profile half-obovate, strongly curved backward. the ventral suture concave, the prow slender but prominulous, the style base excentrically terminal, the valves at very base hyaline, thence papery, densely villosulous, glandless or almost so; *seed* 2–2.4 mm long.

A species readily recognized by the combination of silvery- or gray-villous vesture, relatively numerous (mostly 5–8) pairs of narrow leaflets, and a loose spike of pale purple or pinkish flowers. In its immense range of dispersal, which extends from the cold prairies of southern Saskatchewan south to the warm-temperate Coastal Plain in eastern Texas, it has become adapted to a wide range of climatic conditions, and being a nearly obligate psammophyte, restricted to islands, of greater and less extent, of dunes, sand bluffs, or sandy woodlands southward, it has become a fine mosaic of small races, variable in stature, density of pubescence, length of hairs, size of calyx and petals, and other small features. On the northern and higher western prairies the stems are usually short, diffuse, and densely villous, and the leaflets are small and crowded. In this region when the root is exposed by shifting of the sand it may sprout adventitious stems, the plant appearing stoloniferous in consequence; but the root-stock is normally determinate, with stems all arising from a thickened crown or short caudex. At lower elevations southeastward the stems tend to become longer, at first diffuse but near the southern limit of dispersal tall and erect, with thinner vesture and larger leaflets. This variation in size and pubescence is nowhere correlated with flower size. The southern extreme from eastern Texas was described as a distinct species, *P. griseum* T. & G., at a time when only two or three collec-

tions of western *P. villosum* were available for comparison. The original differential characters of *P. griseum* were thin pubescence and prominently dotted foliage; in reality the foliage of the western type is as strongly punctate, the dots merely being masked by hairs. Time has dissipated the supposed differences and has supplied no reliable substitutes. Rydberg (1920, p. 122) thought *P. griseum* differed from *P. villosum* in orientation of the leaves, but this is not detectable in the material I have seen. Turner (1959, p. 160) ascribed to *P. villosum* a calyx 4–5 mm and to *P. griseum* a calyx 3–4 mm long, with consequently broader or narrower spikes. Dwarf, densely pubescent plants from the Dakotas yield calyces 3–4 mm long and spikes 7–10 mm diam. The fallibility of these morphological characters was apparent to Wemple (1970, pp. 58–61, figs. 10A, 12A), who nevertheless felt that *P. griseum* could be maintained as a distinct species so long as emphasis is laid on a syndrome of characters no one of which was entirely reliable, but which generally coincide within a correlated geographic range. Now these conditions are, to my way of thinking, precisely those that characterize vicariant subspecies. In stressing the readily visible but rather superficial differences in stature and pubescence Wemple seems rather to devaluate the multiple similarities and especially the structurally identical flowers. The weakness of the following varietal key is here symptomatic of the situation.

Key to the Vareities of *Dalea villosa*

1. Stems relatively short, up to 5 dm long, mostly less, or if longer diffuse and trailing, like the leaves densely villosulous and usually greenish beneath the vesture; *leaflets* up to 10 (11) mm long; w. Texas n. to s. Canada, Minnesota, Wisconsin. 45a. var. *villosa*.
2. Stems taller, erect, mostly 5–8 (9) dm tall, more thinly pubescent, commonly reddish, the foliage commonly gray or greenish-gray; *larger leaflets* well over 1 cm long; e. Texas and adjoining Louisiana. 45b. var. *grisea*.

45a. DALEA VILLOSA (Nuttall) Sprengel var. VILLOSA
(Plate LVI)

Characters as in key; 2n = 14 (Ledingham, 1957, ex Wemple, 1970, p. 12).—Collections: 70 (ii).

Dunes, blowouts, sandy talus under bluffs, alluvial sands along intermittent creeks, and open sandy prairies, southward sometimes in sandy oak woodland, in Colorado reaching 1440 m (4800 ft) but mostly lower, widely but discontinuously dispersed over the prairies from s. Saskatchewan and the Souris River in s. Manitoba to w.-centr. Texas, w.-ward entering extreme e. Montana on the lower Yellowstone River, n.-e. and s.-e. Colorado on the South Platte and sources of the Cimarron, and the n.-w. corner of New Mexico (Union and Quay counties), e. to the upper Mississippi valley along the Minnesota-Wisconsin boundary, the Missouri valley in e. Kansas, and the Arkansas and Canadian valleys in e.-centr. Oklahoma; records from Michigan (Ann Arbor, *Clark*, NY) and Missouri (not mentioned in Steyermark's state flora) are very questionable; cf. Wemple, 1970, map 9.—Flowering June to August—Citation of representative specimens of this well-known entity superfluous here.

Dalea villosa (Nuttall) Sprengel, Syst. **3**: 326. 1826, based on *Petalostemon villosus* (softly hairy) Nuttall, Gen. **2**: 85. 1818.—"On the sandy banks of Knife river, near Fort Mandan, Missouri."—Holotypus, PH (not seen, but recently revised by Wemple, 1970, p. 59).—*Kuhniastera villosa* (Nutt.) O. Kze., Rev. Gen. 192. 1891.

45b. Dalea villosa (Nuttall) Sprengel var. grisea (Torrey & Gray) Barneby

(Plate XLVI)

Characters as in key. — Collections: 16 (o).

Openings in woodland, prairie, and abandoned fields, in deep sandy soil, on the Sabine, Trinity and lower Brazos rivers in s.-e. Texas, s. to Houston, n. to Wood and Upshur counties, thence e. to Bienville Parish in n.-w. Louisiana; cf. Wemple, 1970, map 9. — Flowering May and June. — *Representative*: Texas: *Reverchon 1949* (NY); *B. L. Turner 3892* (WIS); *Wemple 434* (NY); *Lundell 9424* (TEX). Louisiana: *Dormon s. n. in 1930* (NY).

Dalea villosa (Nuttall) Sprengel var. **grisea** (Torrey & Gray) Barneby, comb. nov., based on *Petalostemon griseum* (gray, of the leaves) T. & G., Fl. N. Amer. **1**: 310. 1838. — "Pine-woods near the Sabine River, Dr. Leavenworth! Texas, Drummond!!" — Lectotypus (Wemple, 1970, p. 58), collected by Leavenworth "2 miles from the Sabine, in Texas", NY (herb. Torr.)! paratypi, *Drummond 83, Coll. III,* NY, W! — *Kuhniastera grisea* (T. & G.) O. Kze., Rev. Gen. 192. 1891. *Dalea grisea* (T. & G.) Shinners, Field & Lab. **17**: 84. 1949.

Distinguished from var. *villosa* by the taller, more erect stature and thinner vesture, revealing the reddish epidermis of the stem and the greenish surface of the mostly larger leaflets. Differences in shape of the banner blade, mentioned by Wemple, are not consistent. Wemple also notes the presence of empty bracts scattered along the peduncle below the first flower, but these occur occasionally in var. *villosa*.

46. Dalea purpurea Ventenat

(Plate LVIII)

Perennial herbs from tough brown or blackish, rarely yellow roots, sometimes developing a knotty subterranean caudex, 2–9 dm tall, either glabrous to the spikes or (more commonly) thinly pilosulous, especially on petiolule and lower face of leaflets, or densely softly pilosulous nearly throughout, the weak spiral, spreading or ascending hairs up to 0.3–0.8 (1) mm long, the striate-ribbed, glandless or remotely minutely microglandular, pale green or stramineous stems most often erect and virgately ascending, few-branched distally into a subcorymbose panicle of 2–several heads, but not seldom (especially n.- and n.-w.-ward) simple and monocephalous, when either erect or diffuse, or (especially s.-e.-ward) diffuse and branched, nearly always densely leafy, the primary cauline leaves subtending short-shoots or fascicles of smaller leaves, the foliage vivid green, greenish-glaucescent, or ashen-pilosulous, the leaflets smooth above, normally punctate beneath; *leaf-spurs* 0.4–1.6 mm long; *stipules* subulate to narrowly lance-acuminate or -caudate, (1.5) 2–6 (7) mm long, early brown or stramineous, in age dry and fragile, either glabrous or ciliolate; *intrapetiolular glands* 0; *post-petiolular glands* mostly minute and immersed, sometimes 0; *leaves* petioled, the primary cauline ones 1.7–4 (4.5) cm long, with narrowly thick-margined, remotely punctate rachis and nearly always 5, exceptionally 3 or 7 linear-oblanceolate, linear, or linear-elliptic, abruptly short-acuminate or acute, tightly involute or if explanate then marginally elevated, dorsally carinate leaflets up to (7) 10–24 (28) mm long, the terminal leaflet either subsessile or very short-stalked, usually a trifle longer than the rest, the leaves of spurs and some upper leaves mostly

3-foliolate, their leaflets of the same type but smaller; *peduncles* almost 0 up to 9, rarely 15 cm long, the first spike of each principal stem-axis usually pedunculate but the lateral ones subsessile, when stems monocephalous the spike either pedunculate or sessile; *spikes* very dense, conelike, ovoid becoming oblong-cylindroid, without petals 7–12 (13) mm diam, the densely villosulous axis becoming (1) 1.5–7 cm long; *bracts* disjointing only with the fruiting calyx, subdimorphic, the lowest firm, ovate- to lance-acuminate or -caudate, 2.5–7 mm long, the recurving tail 1.5–4 mm long, the interfloral ones (2.3) 2.7–5.8 mm long, 1–1.8 (2.2) mm wide, the papery, stramineous or castaneous-flecked, membranous-margined, glabrous or subglabrous body oblanceolate or spatulate in outline, sometimes charged dorsally with 1–2 small livid glands, at apex densely pilosulous on the back and ciliolate, abruptly contracted into a subulate, erect or recurved, usually livid, either glabrous, puberulent, or rarely pilosulous tail (0.5) 0.7–3 mm long; *calyx* 3.2–4.5 (5) mm long, densely pilosulous throughout with ascending (when dry golden) hairs up to 0.2–0.7 mm long, the tube (1.7) 2–2.8 (2.9) mm long, not recessed behind banner, bluntly pentagonal and not prominently ribbed, the ribs either castaneous or concolorous with the submembranous, heavily castaneous-flecked, glandless intervals, the teeth of nearly equal length but different widths, the 3 dorsal ones lanceolate to narrowly ovate, 1.1–1.9 (2.1) mm long, 0.1–1.4 mm shorter than tube, the ventral pair ovate, up to twice as broad, the blades of all flat, green or livid-castaneous, rarely glabrescent externally, connivent in age; *petals* concolorous, vivid rose- or magenta-purple, pale purple, rarely lilac, pinkish, or exceptionally white, glandless; *banner* (4.3) 4.7–6.7 (7.2) mm long, the filiform claw (2.6) 2.8–4.2 (4.5) mm, the scoop-shaped, apically hooded and obtuse to emarginate blade broadly cuneate to truncate or subcordate at base, 1.7–2.6 (2.8) mm long, 1.7–2.8 (3.2) mm wide; *epistemonous petals* all alike, (3) 3.2–4.5 (5) mm long, the claw 0.5–1.2 (1.6) mm, the oblong or oblong-oblanceolate, obtuse or truncate, apically concave blades 2.5–3.8 (4) mm long, 0.8–1.3 (1.5) mm wide, either cuneate or truncate at base; *androecium* 5.6–8.5 (9) mm long, the column (2.6) 3–4.3 mm, the purplish free filaments up to 3–5.2 (5.5) mm long, the orange-yellow *anthers* (0.7) 0.8–1.3 (1.4) mm long; *pod* obliquely obovoid, 2.1–2.6 mm long, the valves hyaline glabrous in lower ½ or ⅓, thence thinly papery, pilosulous, gland-dotted; *seed* brown or olivaceous, smooth, sublustrous, 1.6–2.1 mm long.

The purple prairie-clover, next to *D. candida* the most widespread of its kind and the prototype of the genus *Petalostemon*, is a familiar wildflower of the prairie states where, in a variety of open habitats its graceful wandlike stems, clad in fine, few-fingered foliage, carry aloft in summer a few hard knobs of silvery calyces ringed with a tassel of purple petals and gold or orange anthers. Its immense range coincides, east of Continental Divide, very nearly with that of *D. candida*. In the rich lowlands of the Mississippi valley the purple and white clovers are often found together, in this region both tall virgate herbs, their stems branching distally into a narrow thyrse or wider, corymbosely flat-topped panicle of heads. Passing west into the colder and drier climate of the short-grass prairie, each is represented by forms of low stature and simpler branching. But where *D. candida* has become modified further in number of leaflets and density of spike, *D. purpurea* remains essentially unchanged in leaf and flower, presenting however a great variety of minor variants differing among themselves in growth-habit, density of vesture, length of peduncle, and diameter of the spike. Already in eastern United States *D. purpurea* has been known from early times as variable in pubescence; plants with glabrous and thinly pilosulous foliage often grow together and both are represented in Michaux's original material from Illinois. On the far western plains and Rocky Mountain piedmont between Alberta and Colorado the variation in pubescence becomes greatly exaggerated, culminating in a

plant densely and softly villous-tomentose throughout, almost suggesting *D. villosa* except for the few leaflets and conelike spike. Plants of this type were described from Montana as *Petalostemon mollis* Rydb., others from Colorado, differing further in obsolescence of the usually conspicuous dots on back of the leaflets, as *P. pubescens* A. Nelson. As I have seen the latter in Colorado (e. of Trinidad, *Barneby 14,997*, CAS, GH, IA, NY, US) it was confined to a peculiar habitat on stiff gumbo clay flats and low bluffs, and with its diffuse stems and relatively broad leaflets and petals appeared sharply marked. But analysed, the morphological features of these pubescent types do not reveal any discontinuity separating them from sympatric glabrescent phases of *D. purpurea*, and I agree with Wemple (1970, p. 90) that they are best treated taxonomically as minor variants.

Over the greater part of its range *D. purpurea* has calyces uniformly pilosulous from base to points of the teeth, usually so densely so as to conceal the greenish-glaucous or castaneous-flecked epidermis. In the Ozarks, and sporadically north into central Kansas and (according to Wemple) even Wisconsin, the calyx-vesture becomes concentrated in lines running lengthwise along the angles of the tube leading to the sinuses and on margins of the teeth, while the intercostal intervals of the tube and the external face of the teeth may become only thinly puberulent, in consequence glaucous. A calyx of this sort is strongly reminiscent of that of the closely related *D. compacta* except that it is always smaller. I follow Steyermark (Fl. Missouri 901) and Wemple (1970, p. 91) in my interpretation. A form with small leaves and small heads, somewhat isolated from the main range of the species in middle Louisiana and Alabama, likewise noted by Wemple (1970), and ecotypes from dune habitats as far apart as the shore of Lake Michigan in Indiana (= fma. *arenarium* Gates), the upper Red River in Manitoba, and the Arkansas valley in central Kansas, seem to reflect the selective influence of habitat on a somewhat plastic genotype.

In the Texas Panhandle and adjoining New Mexico, w. Oklahoma, and thence north through far western Kansas and (well out from the Rocky Mountain piedmont) eastern Colorado into Nebraska, *D. purpurea* is represented by a series of forms, found mostly on dunes or sandy habitats connected with river bluffs and streambeds below the level of the sedimentary caprock, notable for their small narrow flower-heads, without petals about 7–9 mm diameter, raised above the foliage on a distinct peduncle. The flower is not different from that of *D. purpurea* elsewhere, and the foliage appears identical. Wemple has segregated this material as *Petalostemon arenicola*, emphasizing not only the narrow pedunculate spike which is, I agree, the principal differential character, but also the shorter, usually unbranched (therefore monocephalous) stems glabrous to the base of the spike, more conspicuously ciliolate bracts, and a more oblique, proportionately narrower ovary. These supporting characters attributed to *P. arenicola* are somewhat weakened by the phototype accompanying the protologue (Wemple, 1970, fig. 8) which shows a plant freely branching both at base and distally (all main stems several-headed), and peduncles little longer than found in some unquestioned *D. purpurea* from the northern prairies. Interfloral bracts in the narrow spike tend to be a trifle broader proportionately to their length than elsewhere in *D. purpurea* but I have been unable to confirm any substantial difference in pattern of their pubescence, a feature in any case so variable in *D. purpurea* and its relatives that it can command little respect in any particular case. In aspect, however, *P. arenicola* is indeed rather distinctive and recognizable, at first glance suggesting often some form of the allopatric, calciphile *D. tenuis* (or *P. stanfieldii*), for which it has been mistaken. It is obviously different from *D. tenuis* in the antrorse pubescence of the calyx-tube, and even more so from the partly sympatric but there ecologically separated *D. tenuifolia*, which has a loose spike, broader interfloral bracts, and a softly long-pilose calyx dissimilar in form. The range of *P. arenicola* occupies a not quite perfect enclave within that of several minor geographic variants of *D. purpurea* which surround it on all sides except the south. The epicenter for sharply focussed *P. arenicola* lies on

the Staked Plains between the upper Red River in Texas and the Arkansas valley in eastern Colorado. Northward from the Arkansas the populations become less distinctive, in Nebraska fading out into the short-stemmed, high prairie form of *D. purpurea* mentioned earlier. The segregate is treated below as a fairly well defined geographic variety.

Key to the Varieties of *Dalea purpurea*

1. Spikes without petals 9.5–12 mm diam; widespread and extremely variable in stature and pubescence, but when low (stems less than 5 dm) or when from the High Plains, the stem usually leafy almost to the spike. 46a. var. *purpurea*.
1. Spikes without petals 7–9 mm diam; *peduncles* mostly 3–15 cm long; *foliage* usually glabrous; *stems* mostly 2–4.5 dm long; Llano Estacado, n.-w. Texas and adjoining New Mexico, n. through far w. Oklahoma and Kansas and adjoining Colorado to the Arkansas River, thence (becoming rare and less distinctive) to the North Platte in far w. Nebraska. 46b. var. *arenicola*.

46a. DALEA PURPUREA Ventenat var. PURPUREA
(Plate LVIII)

Stems 2–9 dm tall; foliage glabrous, puberulent, thinly pilose, or densely gray-tomentulose; *peduncles* mostly very short, rarely up to 1 dm long; *spikes* 9.5–12 mm diameter; 2n = 14 (Wemple, 1970, p. 12). — Collections: 239 (vi).

Prairies, prairie-bluffs, and glades in oak-cedar barrens, occasionally on alluvial river-sands, inland dunes, and lake-shores, intolerant of shade but adaptable to diverse soils, from heavy chernozems of high-grass prairie to thin stony loams of the western Plains, especially vigorous on but not confined to sedimentary bedrock, the petals sometimes more vividly colored on limestone, common, locally abundant, and widespread on the Atlantic slope from Alberta, where extending n. to Fort Saskatchewan and w. into the foothills up to 1300 m (4330 ft), s. to the Rio Grande valley in Santa Fe and Sandoval counties, New Mexico, in Colorado reaching 1800 m (6000 ft) or on Mesa de Maya 2240 m (7800 ft). e. through the Saskatchewan and Qu'Appelle valleys to Red River in s. Manitoba, the s.-w. shores of Lake Michigan and centr. Illinois, the Ohio valley in Kentucky (Nelson County), and discontinuously to s.-w. Alabama, centr. Louisiana, s. over the central Plains to Red River in Oklahoma and weakly in Texas to the n. edge of Edwards Plateau; collected as a roadside immigrant in n.-centr. Arizona, and reported (Wemple, 1970, map 15) from one disjunct station (native ?) in trans-Pecos Texas. — Flowering May to August s.-ward, rarely later, from mid-June on the high plains. — Citation of representative material of this widely familiar species superfluous.

Dalea purpurea (purple, of the petals) Ventenat, Descr. Pl. Cels, Pl. 40. 1800. — "Plante...découverte par Michaux dans le pays des Illinois." — Holotypus, a specimen presumably cultivated in hort. Cels. from Michaux's seed, G (not examined, but verified by Wemple, 1970, p. 87), the protologue and accompanying plate in any case decisive. — *Psoralea purpurea* (Vent.) MacM., Metasp. Minn. Vall. 329. 1892. *Petalostemon purpureum* (Vent.) Rydb., Mem. N. Y. Bot. Gard. **1** (Fl. Mont.): 238. 1900.

Dalea violacea (violet-colored) Michaux ex Willdenow, Sp. Pl. **3**: 337. 1802. — Holotypus, B (herb. Willd.), not seen but derived from and duplicated in herb. Michx. (v.

sequ.) and verified by Wemple, 1970. *Petalostemum violaceum* Michaux, Fl. Bor. Amer. **2**: 50, tab. 37, fig. 2. 1803, a proposition independent of Willdenow but best treated as an inadvertent derivative of the last. — Specimina authent., P (herb. Michx.)! — *Kuhnistera violacea* (Michx.) Ait. ex Steud., Nomencl. ed. 2, **1**: 851. 1840.

Petalostemon mollis (soft, of the vesture) Rydberg, Mem. N. Y. Bot. Gard. **1** (Fl. Mont.): 238. 1900. — "MONTANA. Snowy Mts., 1882, *Canby*; Hound Creek, 1883, *Canby in 1882*, from "Cameron's Ranch s. of Snowy Mts.", NY! isotypi, GH, US! paratypi, as cited, NY! — *P. purpureus mollis* (Rydb.) A. Nels. in Coult. & Nels., New Man. 299. 1909.

P. pubescens (hairy, of the leaves) A. Nelson, Bot. Gaz. **31**: 395. 1901. — "The species is founded on no. 247 from Berwind, Colorado, by Jennie M. Archibald." — Holotypus, RM, verified by Wemple, 1970, p. 87. — *P. purpureum* var. *pubescens* (A. Nels.) Harringt., Man. Pl. Colo. 319. 1954.

P. standleyanus (Paul Carpenter Standley, 1884–1963) Rydberg, N. Amer. Fl. **24**: 131. 1920. — "Type collected in the Raton Mountains, New Mexico, August 18–19, 1903, *David Griffiths 5464*..." — Holotypus, US!

P. purpureum fma. *arenarium* (of sands) F. C. Gates, Torreya **11**: 127. 1911. — "TYPE. (Gates 2922)...at Waukegan, Lake County, Illinois, August 7, 1908." — Holotypus, F, verified by Wemple, 1. c.

P. purpureum fma. *albiflorum* (white-flowered, an albino variant) Horr & McGregor, Trans. Kans. Acad. Sci. **55**: 175. 1952. — "The type is *McGregor 4986*...July 17, 1951, 4 mi. S. Lawrence, Douglas County, Kansas..." — Holotypus, KANU, verified by Wemple, 1970. — *Dalea purpurea* fma. *albiflora* (Horr & McGreg.) McGreg. Trans. Kans. Acad. Sci. **60**: 161. 1957.

P. violaceum var. *pubescens* (hairy) Gray, Pl. Wright. **1**: 46. 1852, p. p., as to *P. violaceum* sensu Gray, Pl. Fendl. 33. 1849 ("Five miles west of Las Vegas, New Mexico *Fendler 137*") but excluding other elements, among them the lectotypus (Heller, 1901), which = *D. compacta* var. *pubescens* (Gray) Barneby. — All derivatives, *P. purpureum* fma. *pubescens* (Gray) Fassett, 1936, and *P. purpureum* var. *pubescens* (Gray) Boivin, 1960 (comb. illegit., non *P. purpureum* var. *pubescens* (A. Nels.) Harringt.) even though intended to refer to the pubescent state of *D. purpurea* must follow the lectotypification and fall into synonymy of *D. compacta* var. *pubescens*, q. v.

This delightful prairie-clover, first cultivated in Europe about 1800 and subsequently in England during the vogue for American plants, has been figured repeatedly, but never so well as by Redouté in the original publication. See however Sims, Bot. Mag. **41**: tab. 1707; Steyermark, Fl. Missouri Pl. 213, fig. 7.

46b. DALEA PURPUREA Ventenat var. ARENICOLA (Wemple) Barneby
(Plate LVIII)

Closely resembling smaller forms of var. *purpurea* except in the narrow and usually pedunculate spikes; *stems* up to 2–4.5 dm long; *foliage* glabrous or nearly so; *peduncles*, at least of central or primary spikes, 3–15 cm long; *spikes* 7–8.5 mm diam, the axis 1–4 (5) cm long; 2n = 14 (Wemple, 1970, p. 12). — Collections: 25 (iii).

Sandy bluffs, dunes, and sandy alluvial flats along streams or dry watercourses, 570–1300 m (1900–4330 ft), locally abundant on the Staked Plains and short-grass prairies drained by the upper Red and Canadian rivers in n.-w. Texas, immediatedly adjacent New Mexico, and far w. Oklahoma, in Texas s. to the sources of the Colorado and Concho rivers, n. through the s.-w. quarter of Kansas drained by the Cimarron and Arkansas rivers and extreme e. Colorado on the upper Republican and Frenchman rivers to the forks of the Platte in w. Nebraska, there passing into var. *purpurea*. — Flowering (May) June to August. — *Representative*: COLORADO: *Ripley & Barneby*

10,164 (NY); *Stephens & Brooks 24,075* (NY). KANSAS: *Rydberg & Imler 718, 926* (NY); *Barneby 14,986* (CAS, IA, NY), *14,987* (NY). OKLAHOMA: *Waterfall 8970, 9055* (NY). TEXAS: *Reverchon 3007* (NY); *Ferris & Duncan 3360, 3510* (NY). NEW MEXICO: *Goodman & Hitchcock 1116* (NY, UC).

Dalea purpurea Ventenat var. **arenicola** (Wemple) Barneby, stat. nov., based on *Petalostemon arenicola* (dwelling on sand) Wemple, Iowa State Jour. Sci. **45**(1): 94, figs. 8 (phototype), 11, I (petals), 12, D + map 13. 1970. — "Typus, ISC (*Wemple 319*)." — Holotypus, collected on stabilized dunes 5.5 mi s. of Lakin, Kearney Co., Kansas, June 11, 1963, seen only in photograph cited; isotypus, NY!

47. DALEA COMPACTA Sprengel
(Plate LVIII)

Perennial herbs from a thick tough root and when adult a shortly forking caudex, 3–6 (7) dm tall, varying from almost glabrous (but at least stipules and often leaf-rachis retaining vestigial vesture) to thinly pilosulous nearly throughout with fine weak spreading-ascending hairs up to 0.3–0.6 (0.7) mm long, the stem either simple and monocephalous, but bearing leaf-spurs in most primary leaf-axils, or few-branched at or beyond middle, either erect, ascending, or diffuse, prominently ribbed, remotely punctate or microtuberculate, the foliage bluish-green or subglaucescent, the leaflets scarcely bicolored, punctate beneath; *leaf-spurs* almost 0 up to 1 mm long; *stipules* narrowly subulate to linear-aristiform, early dry and fragile, 1.5–5.5 mm long; *intra-petiolular glands* minute; *post-petiolular glands* small, not or scarcely protuberant; *leaves* petioled, the primary cauline ones (2) 2.5–5.5 cm long, with narrowly thick-margined, usually punctate rachis and (1) 2–3 (4) pairs of linear to linear-elliptic, mostly acute and mucronulate, flat but marginally involute or strongly inrolled leaflets up to (1) 1.2–2.5 cm long, the leaflets of axillary spurs similar but mostly 3 and shorter; *peduncles* 0–15 cm long; *spikes* very dense and conelike, ovoid becoming oblong or subglobose, each side composed of ascending spirals of 5–8 calyces, the whole without bracts, petals or androecia 10.5–14 (15) mm diam, the pilosulous axis (0.5) 1–3 cm long; *bracts* persistent, the lowest firm, thinly pilosulous or glabrate, ovate to ovate-acuminate or -caudate, the upper ones obovate to oblanceolate, contracted into a glabrous, livid tip 0.7–4 mm long, papery at very base, usually velvety-pilosulous dorsally at middle; *calyx* (4.4) 5–6.2 mm long, densely pilosulous about the orifice, along margins of teeth, and in lines along the obtuse angles below each sinus, with dense, plushlike indument of subappressed and ascending hairs up to 0.1–0.25 mm long, the tube 3–3.8 mm long, not recessed behind banner, at base membranous and brownish, thence (dry) appearing either whitish or glaucous-green (but brownish within or when moistened), the ribs immersed, the intervals firm, eglandular or minutely livid-punctate, the teeth of subequal length but dissimilar in form, the 3 dorsal ones broadly subulate, the ventral pair deltate-ovate, the longest (1.2) 1.4–2.4 mm long; *petals* concolorous, vivid rose-lilac or rose-purple, glandless; *banner* 5.4–9 mm long, the claw 3.4–5.8 mm, the ovate-oblong or -deltate, basally cordate or truncate, apically obtuse, strongly hooded blade 2.2–3.5 mm long, 2.4–3.6 mm wide; *epistemonous petals* all alike, 3.5–5.4 mm long, the claw 0.6–1.8 mm, the oblong or oblong-oblanceolate blades 2.8–4 mm long, 1.1–1.8 mm wide, at base either 2-auriculate or cuneate, at apex hooded, obtuse or emarginate; *androecium* 8–10.5 (11.2) mm long, the column 4.5–5.6 (6) mm, the purple free filaments up to (3.3)

3.5–5 (5.4) mm long, the connective gland-tipped, the anthers orange-yellow, 1.15–1.5 mm long; *ovary* glabrous or very thinly pilosulous at apex; *pod* (little known) obliquely obovoid, 3–3.5 mm long, the style-base excentrically terminal, the prow transversely dilated, corneous.

A species closely related to *D. purpurea*, with which it hybridizes in Red River valley (Wemple, 1970, p. 74), but differing in the larger, obtuse-angled calyx glabrous and pallid-glaucescent distally except for lines of plushlike pubescence around margins of the teeth, orifice, and often along the angles of the tube. In general the flowers, and so the spikes, are larger, the androecia longer, and the petals more ample. The superficially very similar *D. tenuis* is readily distinguished by the retrorse pubescence of the calyx-tube. The species is variable in growth-habit, length of peduncle, and particularly in length of interfloral bracts, the last two becoming longer in the eastern third of the species-range. Hesitantly I follow tradition in recognizing within *D. compacta* two intergradient entities corresponding with *Petalostemon decumbens* and *P. pulcherrimum* as defined by Wemple; they are weakly differentiated but seem to follow a geographic pattern of some significance. For interpretation of the name *D. compacta*, long ago erroneously transferred to the species herein called *D. cylindriceps*, see under var. *compacta* following.

Key to the Varieties of *Dalea compacta*

1. Spikes sessile or shortly pedunculate, but raised no more than 2.5 cm above the last leaf; *bracts* elongate, the lower interfloral ones 4.5–7.5 mm long, the caudate tip much exceeding the subtended calyx; relatively eastern, in Red River valley in s.-e. Oklahoma (e. from Bryan County) and adjoining Texas and Arkansas (Little River County), and disjunctly on calcareous prairie of the Gulf Coastal Plain in s.-e. Texas. 47a. var. *compacta*.
1. Spikes definitely pedunculate, raised (1.5) 2–15 cm above the last leaf; *bracts* short, the interfloral ones 2–5 mm long, shorter than or as long as the subtended calyx; relatively western, from Red River valley in s.-centr. Oklahoma (Marshall County) s. through e.-centr. Texas to Balcones Escarpment and sparingly e. onto the Coastal Plain to latitude of Jackson County. 47b. var. *pubescens*.

47a. DALEA COMPACTA Sprengel var. COMPACTA
(Plate LVIII)

Stems commonly decumbent; *leaflets* often 3+ mm wide; otherwise as given in key. — Collections: 16 (i).

Calcareous or chalky prairies, s.-ward on chernozem soils of the Coastal Plain, local, Red River valley in s.-e. Oklahoma, downstream from Bryan County, and adjoining Texas and Arkansas; disjunctly on the Coastal Plain of s.-e. Texas; cf. Wemple, 1970, map 14, as *Petalostemon decumbens*. — Flowering April to June. — *Representative*: OKLAHOMA: *Waterfall 12,427* (OKLA, UC, WIS); *Stevens 3639* (NY); *Ripley & Barneby 7427* (NY); *Wemple & Jackson 579* (NY). ARKANSAS: *Moore & Iltis 442, 5159* (WIS). TEXAS: *Wemple & Jackson 731* (NY).

Dalea compacta (dense, of the spike) Sprengel, Syst. **3**: 327. 1826. — "*Ad fl. Rio Roxo in ditione Arkansa Amer. bor.*" — Holotypus not known to survive, but presumed to be

an isotypus of *Petalostemon decumbens* Nutt. — *Petalostemon compactus* (Spreng.) Swezey in Doane, Coll. Nat. Hist. Stud. **1** (Neb. Fl. Pl.): 6. 1891, exclus. syn. & pl. cit. *Kuhniastera compacta* (Spreng.) O. Kze., Rev. Gen. 192. 1891, exclus. syn.

Petalostemon decumbens (lying down, of the stems) Nuttall, Jour. Acad. Philad. 7: 93. 1834. — "On the plains of Red river, common." — Lectoholotypus (Wemple, 1970, p. 84, 86), collected by Thomas Nuttall near Fort Towson, in present Choctaw County, Oklahoma, in May, 1819, NY! isotypi, GH, K (herb. Benth., herb. Hook.), P! — *Kuhniastera decumbens* (Nutt.) O. Kze., Rev. Gen. 192. 1891.

The var. *compacta* is poorly differentiated from the widespread var. *pubescens* by the combination of shortly stalked flower-spike and elongate bracts projecting beyond the calyces. In addition the stems are more often diffuse than those of var. *pubescens*, and the leaflets of primary leaves are often broader; but the individual flowers are identical: My concept of var. *compacta* coincides exactly with *Petalostemon decumbens* of Wemple (1970, p. 84, fig. 11b), who remarks on the curious bicentric distribution, with a gap of 200 miles separating the populations on Red River and those in southeastern Texas. This difficulty largely disappears if var. *compacta* is reinterpreted as an eastern variant of var. *pubescens* (= *Petalostemon pulcherrimum* of Wemple's revision), the collective range of the species, sens. lat., here called *Dalea compacta*, being then continuous across the eastern half of Texas, with var. *compacta* emerging around two peripheral segments.

The epithet *compacta* is taken up, following Shinners (1949, p. 83) for *Petalostemon decumbens* in the belief that Sprengel could have received plants from Red River in what was then called "Arkansa" (including much of present Oklahoma), *before 1826*, only from Nuttall. Nuttall is known to have sent Sprengel a set of his Arkansas collections of 1819, among them material of *Dalea lanuginosa* Nutt. which Sprengel renamed *D. lanata*. Sprengel's disregard for Nuttall's manuscript names led to a historic quarrel, so we should not be surprised to find in the case of *Petalostemon decumbens* a similar change of epithet. The locality given for Sprengel's two *Dalea* is the same, just as the locality given by Nuttall for his *D. lanuginosa* and *P. decumbens* are the same. Not only does the circumstantial evidence point strongly to the identity of *D. compacta* and *P. decumbens*, but the species to which the epithet *compacta* has been applied in recent years (see discussion of *D. cylindriceps*) lies beyond the limit attained by botanical exploration at the period when Sprengel was composing his Systema.

47b. DALEA COMPACTA Sprengel var. PUBESCENS (Gray) Barneby
(Plate LVIII)

Stems commonly erect or ascending at angles of 45–70°, but sometimes diffuse; *leaflets* mostly less than 3 mm wide; 2n = 14 (Wemple, 1970, p. 12); otherwise as in key. — Collections: 37 (v).

Stony limestone hills, live-oak savannahs, and mesquite prairie, mostly below 450 m, widespread and locally abundant over the hill country of e. Texas, n. to both banks of Red River in s.-centr. Oklahoma and adjacent Texas, s. to Balcones Escarpment, w. to Eastland and Kerr counties, s.-e. on the Gulf Coastal prairies to Jackson County; isolated outliers near Amarillo in the Texas Panhandle, in Caddo Parish, Louisiana, and (according to Wemple, 1. c.) in trans-Pecos Texas and the Rio Grande valley are perhaps introduced or mistakenly labelled; cf. Wemple, 1970, map 14. — *Representative*: OKLAHOMA: *Wemple 402* (NY). TEXAS: *E. Hall 139* (NY); *Cory 53,308* (NY, UC), *53,336* (NY); *Tracy 8041* (NY, UC); *Barneby 14,491* (CAS, F, IA, MICH, NY, UC, US), *14,500* (IA, NY, US), *14,503* (CAS, NY); *A. Heller 1857* (NY, OKLA, UC, US, WIS); *Wemple 234* (NY).

Dalea compacta Sprengel var. **pubescens** (Gray) Barneby, comb. nov., based on *Petalostemon violaceum* var. *pubescens* (hairy) Gray, Pl. Wright. **1**: 46. 1852, p. 9., quoad basonym. Scheeleanum et pl. tex. Wrightianam, exclus. "Pl. Fendl. 33" plantisque ibi citatis. – Lectoholotypus (Heller, 1901, l. c. infra): *Wright* from Austin, Texas [no. 117], GH! – *Petalostemon pubescens* (Gray) A. Hell., Muhlenbergia **1**: 28. 1901 (Aug), homon. posterior (non *P. pubescens* A. Nels., 1901, Jun). *P. purpureum* var. *pubescens* (Gray) Boivin, Nat. Canad. **87**: 43. 1960, homon. posterior (non *P. purpureum* var. *pubescens* (A. Nels.) Harrington, 1954).

Petalostemon virgatum (rodlike, of the stems) Scheele, Linnaea **21**: 461. 1848. – "Auf trocknen Prairieen bei Neubraunfels [Comal County, Texas]: Lindheimer." – Holotypus, formerly (?) B, not seen; presumed isotypi (cf. Wemple, 1970, p. 82, quoting Gray and A. Heller): *Lindheimer 42*, GH (3 sheets)! – *Kuhnistera pulcherrima* (fairest of all) A. Hell., Contrib. Herb. Franklin & Marshall Coll. **1**: 50. 1895, a superfluous substitute. *Petalostemon pulcherrimum* A. Hell., Bull. Torrey Club **26**: 593. 1899, a legitimate substitute (non *P. virgatum* Nees, 1840). *Dalea helleri* (Amos Arthur Heller, 1867–1944) Shinners, Field & Lab. **21**: 165. 1953, a legitimate substitute (non *D. pulcherrima* S. & M. ex G. Don, 1832, nec *D. virgata* Lag., 1816).

This is the purple prairie clover most abundant and widespread over much of eastern Texas where, except in the valley of Red River and a few stations southward, it fills the role played by *D. purpurea* on the prairies of middle United States. Essentially Texan, it might be visualized as a magnified edition of the common mould, quite similar to *D. purpurea* in habit and foliage but with swollen heads and more flamboyant tassels of flower. The only strong differential characters between the two species are in the calyces, already mentioned above. My concept of var. *pubescens* is coextensive with *Petalostemon pulcherrimum* of Wemple's revision (1970, p. 81), the difference in names being contingent on taxonomic judgement. Wemple discusses the synonymy in greater detail, supererogatory here. During independent preliminary study I formed the perhaps still arguable opinion that *Petalostemon violaceum* var. *pubescens* Gray, based on pubescent elements of *D. purpurea* and *P. virgatum* Scheele, was hopelessly ambiguous and reasonably discarded as a nomen confusum. Gray's mixture, however, had been analyzed by Heller in 1901 and inferentially typified, with the result that the epithet *pubescens* can be preserved in the varietal category. My combination "*D. compacta* var. *helleri*", employed rather widely in herbarium annotation, is a nomen nudum.

48. Dalea tenuis (Coulter) Shinners
(Plate LIX)

Habit of *D. compacta* var. *pubescens* but commonly lower, 1.5–4 (5) dm tall, the erect of incurved-ascending stems mostly simple and monocephalous, seldom few-branched distally, either glabrous throughout (except for stipule margins) to the inflorescence, or the stem, leaf-rachis and dorsal face of leaflets thinly and weakly pilosulous with ascending hairs up to 0.5 mm long; *stipules* 1–4.5 mm long; *leaves* shortly petiolate, the primary cauline ones 1.5–3.5 cm long, with 3 or 5 linear-involute, acute or obtuse and mucronulate leaflets up to 6–15 mm long; *peduncles* 2.5–15 cm long; *spikes* dense, conelike, subglobose to oblong-cylindroid, the flowers crowded into ranks of 3–4 on each side, the cone of calyces 7–12 mm diam, the axis 0.5–2.5 cm long; *bracts* persistent even after fall of the calyx, 1.5-4.5 mm long, the lowest ovate-acuminate, firm, glabrous or nearly so, the interfloral ones obovate-oblanceolate, beyond the glabrescent base densely silky-pilosulous dorsally, abruptly contracted distally into a livid, glabrous, deltate-acuminate tip 1–2 mm long; *calyx*

3–5.2 mm long, obtusely pentagonal with ± connivent teeth, the firm, eglandular tube 2–3.1 mm long, silky-pilosulous with retrorsely subappressed hairs up to 0.2–0.35 mm long, the ribs immersed, the intercostal panels not externally differentiated in texture, the equally firm teeth of nearly equal length, 1–2.2 mm long, but of different shapes, the 3 dorsal ones broadly subulate, the ventral pair deltate-ovate, all either thinly pilosulous with forwardly subappressed hairs or glabrous except for ciliolate orifice, in that case either green-glaucescent or livid-castaneous; *petals* pink, in form almost as *D. compacta* var. *pubescens*; *banner* 4.6–5.8 mm, the claw 2.4–3.5 mm long, the ovate blade 2.2–2.5 mm long, broadly cuneate to truncate at base, 1.5–2.8 mm wide; *epistemonous petals* ± 3.5 mm long, the oblong-oblanceolate, hooded blade 2-auriculate at base, 2.7–3.1 mm long, 1–1.3 mm wide, abruptly contracted into a claw 0.5–0.7 mm long; *androecium* 6–8.5 mm long, the column 2.5–3.7 mm, the free filaments 2.5–4.8 mm long; *ovary* glabrous except at tip, the style-base pilosulous. — Collections: 20 (o).

Open stony hills on limestone, or live-oak and mesquite savannah, locally common over Edwards Plateau and detached calcareous hill-country of centr. Texas, w. to the latitudes of Abilene and San Angelo, n. almost to Red River in Coke County, s.-e. to Balcones Escarpment in Hays and Bexar counties; cf. Wemple, 1970, map 12. — Flowering May–June, exceptionally again in fall. — *Representative*: TEXAS: *E. J. Palmer 12,257, 12437* (NY, UC); *Tolstead 7369* (NY, UC); *Shinners 24089* (WIS); *J. W. Stanford 1285, 2520* (OKLA); *Wemple 235, 236, 238, 239, 244, 250* (all NY).

Dalea tenuis (Coulter) Shinners, Field & Lab. **17**: 84. 1949, based on *Petalostemon violaceus* var. *tenuis* (slender) Coult., Contrib. U. S. Nat. Herb. **1**: 34. 1890. — "[TEXAS.] Santa Ana (Coleman county)." — Holotypus (Wemple, 1970, p. 92), *Nealley 358 in 1889*, US! phototypus, NY! — *Kuhnistera tenuis* (Coult.) A. Hell., Bull. Torrey Club **23**: 124. 1896. *Petalostemon tenuis* (Coult.) A. Hell., Bull. Torrey Club **26**: 593. 1899. *Dalea purpurea* var. *tenuis* (Coult.) Shinners, Field & Lab. **21**: 165, in obs. 1953.

Petalostemon stanfieldii (Silas Walter Stanfield, 1856–) Small, Fl. S. E. U. S. 1332. 1903. — "Type, San Marcos, *Stanfield*, 1897." — Holotypus, NY! — *Dalea stanfieldii* (Small) Shinners, Field & Lab. **17**: 84. 1949.

Petalostemon grothii (the collector) Macbr., Contrib. Gray Herb., New Ser. **49**: 49. 1917. — "TEXAS:...near Bracken, Bexar Co., July 25, 1903, *B. H. A. Groth*, no. 148. — Holotypus, GH! isotypi, NY, US!

49. DALEA REVERCHONI (Watson) Shinners

(Plate LIX)

Herbaceous from a tough woody taproot, 1.5–2 dm tall, the few, simple or distally 1-branched, densely leafy stems decumbent, prominently ribbed, glandless, rather densely pilosulous with fine incurved or sinuous hairs up to 0.15–0.25 mm long, the aloysia-scented foliage green and glabrous, the leaflets smooth above, punctate beneath; *leaf-spurs* 0.4–1 mm long; *stipules* narrowly subulate to linear-attenuate, 1–3.5 mm long, becoming dry, recurved, brittle, brown or livid; *intrapetiolular glands* minute or 0; *post-petiolular glands* small but prominent, blunt; *leaves* mostly subsessile, the primary cauline ones (all subtending leaf-spurs or branchlets) 2–3 cm long, with 3 or 4 pairs of linear-oblong or -oblanceolate, obtuse, bluntly gland-mucronulate, loosely inrolled or marginally elevated, thick-textured, dorsally carinate leaflets up to 5–12 mm long, the terminal one longest, either sessile or short-stalked beyond the last

pair; *peduncles* up to 1 cm long; *spikes* loose, the flowers (pressed) falling into 2–3 ranks to expose the densely villous-tomentulose axis, without petals 8–10 mm diam, becoming 1.5–5 cm long; *bracts* deciduous narrowly ovate, ± 2.5 mm long, densely pilosulous dorsally; *calyx* 4.2–4.6 mm long, densely silky-pilosulous or -tomentulose from base upward with fine lustrous subappressed hairs up to 0.25 mm long, the pentagonally turbinate tube 1.9–2.1 mm long, not recessed behind banner, obtusely angled by the ribs leading to the sinuses, the ribs leading to the teeth more slender and scarcely prominent, the broad intervals either hyaline or densely castaneous-flecked, glandless, the teeth of nearly equal length, the 3 dorsal ones lance-acuminate, 2.1–2.5 mm long, 0–0.5 mm longer than tube, the ventral pair triangular-acuminate, scarcely shorter, all firmly herbaceous or livid, pilosulous within, spreading in age; *petals* all vivid magenta-purple, glandless; *banner* 4.3–4.6 mm long, the claw 2–2.5 mm, the scoop-shaped, apically hooded, obtuse or subacute blade 2.1–2.3 mm long, 1.8–2 mm wide, broadly cuneate to subtruncate (not cordate) at base; *epistemonous petals* 3.1–3.6 mm long, the claw 0.7–0.8 mm, the oblong, concave, obtuse or subacute blades cuneate at base, 2.6–3 mm long, 1.1–1.3 mm wide; *androecium* 6.1–7.2 mm long, the column 2.5–3.2 mm, the magenta-purple filaments 3.3–4 mm long, the anthers orange; *pod* 3.1–3.5 mm long, in profile plumply half-obovate, the short ventral suture straight or slightly concave, the dorsal one strongly convex, the prow prominent, thickened, the valves thinly papery but not hyaline at base, papery, pilosulous and minutely gland-sprinkled distally; *seed* not seen. — Collections: 3 (i).

Dry stony hillsides on limestone, rare and local on northern outlying spurs of Edwards Plateau in n.-centr. Texas (Hood and Parker counties). — Flowering May–June, September–October. — *Material*: TEXAS. Hood: Comanche Peak, *Reverchon 1273* (NY, US). Parker: 3 mi s.-w. of Springtown, *Barneby 13,529* (CAS, IA, NY SMU).

Dalea reverchoni (Watson) Shinners, Field & Lab. **17**: 84. 1949, based on *Petalostemon reverchoni* (Julien Reverchon, 1834–1905) Wats., Proc. Amer. Acad. **21**: 449. 1885. — "On the rocky top of Comanche Peak, in western Texas, J. Reverchon, June, 1882 (n. 36)." — Holotypus, so labelled (Wemple, 1970, p. 76), GH! isotypus (fragm.), NY! — *Kuhnistera reverchoni* (Wats.) A. Hell., Bull. Torrey Club **23**: 124. 1896.

A strongly marked species, distinguished from the marginally sympatric *D. tenuis* by the short, pilosulous stem contrasting with green leaflets, these seven or nine (not three or five) in the primary cauline leaves, and by the open spike of pentagonal, antrorsely pilosulous calyces. The loose flower-spike distinguishes the species equally from *D. purpurea* or *D. compacta*. The allopatric *D. tenuifolia*, ranging over the high plains of the Texas Panhandle and northwestward into adjoining states, has a relatively loose spike, but once again differs in fewer leaflets (3 or 5), stems pilose only at base and not throughout, and long-pilose calyces subtended by broad, obovate bracts. Only *D. gattingeri* resembles *D. reverchoni* in leaflet-number, and this has an indistinctly ribbed, not bluntly pentagonal calyx.

Until recently *D. reverchoni* was known only from the type-locality, where it was collected first in 1882, and once again in 1900 by Eggert (MO, acc. Wemple, not seen). Wemple (1970, p. 76) thought it might well be extinct, but I had the extraordinary luck to happen on a flourishing colony of plants, sparsely flowering, perhaps unseasonably, in October, 1964. The species must be expected to turn up elsewhere around the northern fringes of Edwards Plateau.

50. DALEA GATTINGERI (A. Heller) Barneby
(Plate LX)

Diffuse perennial herb from thick blackish root, 1.5–3.5 dm tall, appearing glabrous to the inflorescence but the leaf-rachis, the lower (rarely both) faces of leaflets, and stems distally (or some of these) thinly pilosulous with weak, spreading-ascending, ± sinuous hairs up to 0.3–0.5 mm long, the decumbent-incurved, striate, eglandular or remotely minutely microglandular stems either simple or branched distally, or branched throughout, either monocephalous or going out into a central and several smaller lateral spikes, the foliage green, the leaflets scarcely bicolored, punctate beneath; *leaf-spurs* 0.2–1 mm long; *stipules* linear-caudate becoming stiff and setiform, (1.5) 2–6 (7) mm long; *intrapetiolular glands* 2, minute; *post-petiolular glands* small, not or scarcely prominent; *leaves* shortly petioled, the primary cauline ones 2–3.5 cm long, with broadly margined rachis and 5–7 (9) linear, linear-oblanceolate, or -elliptic, obtuse (sometimes gland-mucronulate) flat and marginally inrolled or tightly involute leaflets up to 8–18 mm long, the terminal one subsessile or short-stalked, always the longest, the leaves of axillary spurs shorter, with 3–5 smaller, otherwise similar leaflets; *peduncles* 0.5–2.5 cm long; *spikes* moderately dense, the flowers (pressed) falling into ± 3–4 ranks, oblong to cylindric, (8) 9–10 mm diam, the densely pilosulous axis becoming 1.5–7.5 cm long; *bracts* deciduous by full anthesis but often held fast between the calyces and falling only with the pod, in outline lance-caudate, 3–5 (6) mm long, the lowest firm and persistent, the inner ones papery and pallid at base, distally subherbaceous, greenish or livid, dorsally pilosulous to apex and charged with a few small glands; *calyx* 4–5 mm long, densely pilosulous-tomentulose with sinuous hairs up to 0.25–0.4 mm long, the subsymmetric tube 2–2.5 (2.7) mm long, not recessed behind banner, indistinctly 10-ribbed, the intervals all densely castaneous-flecked, glandless, the teeth unequal, the 3 dorsal lanceolate, up to 1.9–2.8 mm long (0.6 mm longer to 0.6 mm shorter than tube), the ventral pair ovate, all with green or greenish-livid blades, sometimes minutely gland-spurred on margins; *petals* rose-purple, eglandular; *banner* 5.2–6.2 mm long, the claw 3.1–3.9 mm, the ovate blade 2.1–2.6 mm long, (1.6) 2–2.8 mm wide, either broadly cuneate or shallowly cordate at base, hooded at the entire or emarginate apex; *epistemonous petals* 3.5–4.5 mm long, the blades oblong or elliptic-oblanceolate, obtuse, 2.6–3.2 mm long, 0.9–1.3 mm wide, cuneately contracted at base into a claw 0.7–1.4 mm long; *androecium* 6.3–7.8 mm long, the column 2.4–3 mm, the filaments free for 3.8–5.4 mm, the connective gland-tipped, the orange anthers 0.9–1 mm long; *pod* semi-obovate in profile, 2.8–3.3 mm long, the ventral suture nearly straight, the prow slender, the style-base at upper corner, the valves in lower half papery (not hyaline), glabrous, distally firmer, densely pilosulous, microglandular; *seed* up to 2.2 mm long; 2n = 14 (Wemple, 1970, p. 12). — Collections: 19 (i).

Thin stony soils of calcareous cedar-glades and barrens, locally abundant, centr. Tennessee (Nashville Basin to region of Chattanooga) s. into the n.-w. corner of Georgia and n.-w. Alabama (Franklin Co.); cf. Wemple, 1970, map 13. — Flowering May to August. — *Representative*: TENNESSEE: *Demaree 45,747* (DAO, NY); *Wemple 473, 474* (NY); *Barneby 14,979* (CAS, GH, F, IA, NY, US); *Kral 26,950* (OKLA). GEORGIA: *B. L. Turner 4935* (TEX). ALABAMA: *R. L. James s. n. in 1944* (NY).

Dalea gattingeri (A. Heller) Barneby, comb. nov., based on *Kuhnistera gattingeri* (Augustin Gattinger, 1825–1903) A. Hell., Bull. Torrey Club **23**: 121, Pl. 262. 1896.—"...Dr. A. Gattinger...about Nashville and Lavergne, Tenn...specimens are in Curtiss' North American Plants, no. 565..."—Lectoholotypus (Wemple, 1970, p. 80): *Curtiss 565** US! isotypi, K, NY (annotated by Heller), WIS!—*Petalostemon gattingeri* (A. Hell.) A. Hell., Bull. Torrey Club **26**: 593. 1899.

A handsome low prairie-clover, the numerous short stems decumbent and radiating from the heavy rootstock and bearing a chaplet of vivid purple tassels sparked by the orange anthers. The species seems closely related to *D. tenuifolia* which it resembles in its relatively loose flower-spikes, but distinguished by the basally glabrous stems, narrower bracts, and short-pilosulous calyx. The primary leaves of *D. tenuifolia* have only three or five leaflets; those of *D. gattingeri* five, seven and less often nine. The species seems to have been collected first in "Upper Alabama" in 1866 by T. Peters (NY).

51. Dalea tenuifolia (Gray) Shinners
(Plate LX)

Slender perennial herb from a brown woody root and knotty caudex, (1.5) 2–5 (5.5) dm tall, the leafless base of the usually decumbent or diffusely ascending stems always densely pilosulous, the plant thence either glabrous to the inflorescence, or the stem, leaf-rachis, or lower face of leaflets (or some of them) pilosulous with fine, forwardly subappressed to widely spreading hairs up to 0.3–0.8 (1.3) mm long, the pale green or stramineous, ribbed stem either simple or branched only above middle or rarely throughout, the sparse foliage green, the leaflets little bicolored, smooth above, punctate beneath; *leaf-spurs* 0–1 mm long; *stipules* narrowly linear-caudate or setiform, livid or castaneous, becoming dry and fragile; *intrapetiolular glands* minute; *post-petiolular glands* small but prominent, obtuse; *leaves* petioled, the primary cauline ones 2–4 cm long, with thick-margined rachis and 3–5 linear-oblanceolate, either emarginate, obtuse, or subacute and gland-mucronulate, usually involute leaflets up to 1–2.2 cm long, the short-stalked terminal one a little longer than the rest, the leaves of axillary spurs shorter, with mostly 3 leaflets of same type but smaller; *peduncles* 1.5–8 cm long; *spikes* dense in bud, loosening during and after anthesis, becoming oblong-cylindroid or (the lesser lateral ones) subglobose, never conelike, the flowers (pressed) appearing 3–4-ranked, the whole without petals 8–10 mm diam, the densely pilosulous, pitted axis (0.5) 1–7 (9) cm long; *bracts* deciduous by full (or certainly by late) anthesis, 2.5–4.5 (5.5) mm long, the body broadly flabellate-obovate to broadly oblanceolate, 1.2–2.4 mm wide, greenish-glaucescent, pilosulous and inconspicuously gland-dotted dorsally, glabrous within, contracted into a subulate or subulate-attenuate livid tail 1–2 (3) mm long; *calyx* (3.1) 3.4–4.5 mm long, densely pilose with spreading-ascending hairs up to (0.7) 0.9–1.5 mm long, the subsymmetrically obovoid tube not recessed behind banner, (1.6) 1.9–2.4 mm long, bluntly 10-angled, the ribs prominulous but very slender, the almost flat intervals densely castaneous-flecked but glandless, the teeth of subequal length but different shapes, the 3 dorsal ones lanceolate, 1.5–2.1 mm long, the ventral pair ovate-lanceolate to ovate, the blades plane, herbaceous or castaneous; *petals* rose-purple, eglandular; *banner* 5.5–6.5 mm long, the claw 3.2–4 mm, the broadly cordate, apically hooded, obtuse or emarginate blade 2.3–3.1 mm long, 2.6–3 mm wide; *episternonous petals* 4–4.8 mm long, the claw 1–1.5 mm, the oblong or ovate-oblong, basally truncate to broadly cuneate blade 2.7–3.4 mm long, 1.2–1.5 mm wide; *androecium* 6–8.3 mm long, the column 2.2–3.3 mm, the free filaments up to 3.5–5 mm long, the connective gland-

tipped, the anthers 0.9–1.5 mm long, yellow; *pod* 2.8–3.5 mm long, in profile obliquely half-obovate, the ventral suture concavely the dorsal convexly arched, the stylebase excentrically terminal, the prow slender but prominulous, the valves hyaline and glabrous in lower ⅓, thence papery, pilosulous, commonly gland-sprinkled; *seed* ± 2 mm long; 2n = 14 (Wemple, 1970, p. 12); n = 7_{II} (Mosquin). — Collections: 36 (iv).

Stony hilltops, rocky bluffs, and gullied badlands, commonly associated with limestone caprock but sometimes on granites or sandstones, 810–1350 m (2700–4500 ft) and perhaps slightly higher w.-ward, locally plentiful over the short-grass prairies and arid grasslands drained by the upper Canadian, Cimarron, and Pecos rivers in the Texas and Oklahoma panhandles, the n.-e. quarter of New Mexico, and adjoining Colorado and Kansas, extending s. in Texas to the sources of the Brazos in Lubbock and Garza counties, on the Pecos s. to Fort Sumner, thence w. just to the edge of the Rio Grande valley in Sandoval County, in Kansas n. interruptedly to the head of Smoky Hill River in Wallace County; cf. Wemple, 1970, map 12. — Flowering late May to August, in New Mexico sometimes again in fall. — *Representative*: KANSAS: *McGregor 17,307* (NY); *Barneby 14,990* (CAS, IA, NY). COLORADO: *Stephens & Brooks 21,842* (NY). OKLAHOMA: *Waterfall 3122, 3165* (NY). TEXAS: *E. J. Palmer 12, 503* (NY, UC), *13,855* (WIS); *Reverchon 3008* (NY); *Wemple 253, 255* (NY). NEW MEXICO: *Eggleston 20,176* (NY); *Goodding 5654* (NY); *T. & L. Mosquin 5729* (NY).

Dalea tenuifolia (Gray) Shinners, Field & Lab. **17**: 84. 1949, based on *Petalostemon tenuifolius* (thin-leaved) Gray, Proc. Amer. Acad. **11**: 73. 1876. — "Arkansas, at the crossing of Red River, Dr. Newberry; New Mexico, Mr. Dieffendorfer (ex T. C. Porter), J. T. Rothrock." — Lectotypus, *Rothrock 81 in 1874*, collected probably at Algodones, s.-e. Sandoval County, New Mexico, GH (mounted with the conspecific paratypi mentioned above); isotypi, K, NY (herb. Canby), US (*Rothrock 81*)! — *Kuhniastera tenuifolia* (Gray) O. Kze., Rev. Gen. 192. 1891.

Petalostemon porterianus (Thomas Conrad Porter, 1822–1901) Small, Fl. S. E. U. S. 1332. 1903. — "Type, Leavenworth, Ark. to El Paso, Tex., Dieffenderfer, in herb. Lafayette Coll." — Holotypus presumably burned with T. C. Porter's herbarium; isotypus, labelled by Porter = paratypus of *P. tenuifolius* listed in preceding paragraph; clastotypus (fragm. retained by Small), NY! isotypus, GH!

Petalostemon rothrockii (Joseph Trimble Rothrock, 1838–1922) Rydberg, N. Amer. Fl. **24**: 134. 1920. — "Type collected in Arizona, 1874, *Rothrock* (Wheeler Exp., in herb. Columbia Univ.)." — Holotypus, presumably part of *Rothrock 81*, NY! = paratypus of *D. tenuifolius*.

In the context of related prairie-clovers with few leaflets and purple flowers the characteristic features of *D. tenuifolia*, as pointed out by Wemple (1970, p. 77, fig. 11A), are the basally pilose stems and elongating spikes. The broad, thin-textured interfloral bracts are also distinctive. On the Staked Plains the species is sympatric with forms of *D. purpurea*, but in that region is found mostly on limestone caprock whereas *D. purpurea* is in the prairie sod or sands. On the Pecos-Rio Grande divide, however, *D. tenuifolia* forsakes the limestones and appears equally vigorous and at home on granitic bedrock and on gullied badlands.

Wemple (1970) analysed the type-sheet in Gray Herbarium which bears all three collections cited in the protologue, but did not select a lectotype. I here choose *Rothrock 81*, which is represented by duplicates in several other herbaria, one of them being holotype of *P. rothrockii*. Wemple overlooked the real place of publication of the last named, in the appendix to Small's Flora, where the typus is cited in exact detail (cf. supra); the

Dieffenderfer specimen at Gray can be no more than an isotype. If a neotype were needed, the fragment of Porter's own specimen, retained by Small at NY, would be preferable. The origin of *Rothrock 81* deserves a note. Rothrock himself cited under this number and figured in Wheeler's Report 98, Pl. II. 1878 only one purple-flowered *Petalostemon*, using moreover Gray's recently published name *P. tenuifolius*. Unquestionably these references are all based on one collection even though the data of locality differ, Gray giving "New Mexico", Rothrock "Arizona", the latter appearing on the label of the specimen in NY which became type of *P. rothrockii*. Rothrock's collection of 1874 was serially numbered and his Nos. 77 (*Asclepias verticillata*), 78 (*A. involucrata*), 79 (*Penstemon ambiguus*) and 82 (*Riddellia tagetes*) were all cited from Algodones, a village on the Rio Grande near the north end of the Sandia Mountains in southeastern Sandoval County. Under No. 82 the place is mis-spelled Alcadones, and it seems likely that "Arizona" of the Report, later copied onto the label at New York, is another printer's error. I myself have seen *D. tenuifolia* at Placitas a few miles east of Algodones, and I have no doubt that the latter is in effect the type-locality. Newberry's crossing of Red River cannot, of course, have been in the present state of Arkansas but far upstream, very likely in the Texas Panhandle.

IIIC (v). Series KUHNISTERA

Perennial herbs sometimes flowering the first year, glabrous to the spikes; *leaflets* 1–6 pairs, linear-involute or oblanceolate; *spikes* numerous, corymbosely arranged, sessile, subcapitately few-flowered, each subtended by an involucre of 3–4 whorls of enlarged, bracteiform stipules and empty bracts; *calyx* densely pilose externally, a trifle constricted at the subsymmetric orifice, the linear teeth as long or twice as long, becoming setiform and plumose; *petals* white; *androecial column* ± as long as tassel of free filaments. — Sp. 1, polymorphic xerophyte of sands on the coastal plains of s.-e. United States (North Carolina to s. peninsular Florida and s.-e. Mississippi).

Dalea sect. **Kuhnistera** (Lamk.) Barneby ser. **Kuhnistera**. *Kuhnistera* Lamk., sensu str.; Rydb., N. Amer. F. **24**: 135. 1920, Amer. Jour. Bot. **15**: 431, Pl. XXVIII, fig. T. 1928. *Petalostemon* subgen. *Kuhnistera* (Lamk.) Wemple, Iowa State Jour. Sci. **45**(1): 22. 1970. — Cf. also under sect. *Kuhnistera*, supra.

Gatesia Bertoloni, Miscell. Bot. fasc. **7**: 30 (pro gen.). 1848. — Sp. unica: *G. alabamensis* Bert. = (syn. tax.) **Dalea pinnata** var. **trifoliata** (Chapm.) Barneby.

52. DALEA PINNATA (J. F. Gmelin) Barneby
(Plate LXI)

Perennial herbs sometimes of short duration often flowering the first season, with shallow, reddish taproot, (3) 4.5–9 (1) dm tall, glabrous to the inflorescence, the (1) 3–several finely striate, purple-castaneous, at least distally tuberculate stems at very base decumbent but thence abruptly erect, by anthesis naked toward base but upwardly continuously leafy to the sessile spikes, each primary cauline leaf subtending a spur, some of these near or well above middle produced into a spike, the whole inflorescence openly to quite densely corymbose, 4–15 (20) cm across the flat or low-pyramidal top, the thick-textured but often very narrow foliage green, the leaflets smooth above, punctate beneath; *leaf-spurs* 0.5–1.2 mm long; *stipules* narrowly subulate, subglandular, livid 0.4–1.5 (2) mm long, early dry and fragile; *intrapetiolular glands* minute or 0; *post-petiolular glands* present, often small, if prominent obtuse; *leaves* short-petioled, the primary cauline ones (drought-deciduous) 1–2.5 cm long,

with punctate rachis and 3–13 well-spaced leaflets variable in outline from linear-involute to oblanceolate and flat or loosely folded, the longest 5–11 mm long, 0.3–2 mm wide, the terminal leaflet short-stalked, similar to the last pair, the leaves of axillary spurs shorter, mostly 3-foliolate, the leaflets smaller; *spikes* subcapitate, few-flowered, involucrate by 3–4 whorls of enlarged bracteiform stipular spurs, the outermost small and tipped by reduced or vestigial, 3–5-foliolate leaf-blades, the larger inner ones broadly ovate, at apex either acute or bidentate, up to 4–5.5 mm long, 3.5–4 mm wide, the whole involucre at anthesis 6–14 mm diam, passing upward into genuine bracts of abruptly narrower type, oblanceolate or elliptic, obtuse, ± enveloping the flowers, the involucral bracts persistent, papery, purple-castaneous, glabrous dorsally, ciliolate, the outermost often minutely gland-sprinkled; *calyx* (4) 4.5–7.8 (8.2) mm long, pilose with rather stiff ascending, finally divergent hairs up to 0.8–1.4 mm long, the subsymmetric tube a trifle constricted at mouth and a little recessed behind banner, (1.5) 1.7–2.3 (2.7) mm long, the ribs slender, castaneous, the intervals narrow, hyaline glandless, the teeth at first erect, divergent in fruit, narrowly linear becoming stiff and subsetiform, (2.5) 2.7–5.4 (6.2) mm long, all of ± equal length, densely plumose; *petals* white, glandless; *banner* (5) 5.4–8.6 mm long, the lanceolate or oblong-elliptic, basally cuneate or rarely subhastate blade ± as long as the linear claw; *epistemonous petals* resembling the banner but very shortly clawed, 3.7–6.8 mm long, the lanceolate or lance-oblong, rarely elliptic, acute, obtuse, or exceptionally emarginate blades 3–5 mm long, 0.8–1.4 mm wide; *androecium* 8.8–10.8 mm long, the column (4) 4.3–5.8 mm, the free filaments up to 4.2–5.5 mm long, the connective gland-tipped, the anthers 0.65–0.9 mm long; *pod* in profile half-obovate, 2.5–3 mm long, slightly convex ventrally, the prow only a trifle thickened, the style-base excentrically terminal, the valves hyaline and glabrous in lower half, thence thinly papery, pilosulous; *seed* ± 1.7 mm long.

My comprehensive concept of *D. pinnata* is coextensive with genus *Kuhnistera* as understood by Rydberg (1920, pp. 135–6) and with *Petalostemon* subgen. *Kuhnistera* of Wemple's revision. Rydberg recognized two species, *K. pinnata* and *K. adenopoda*; Wemple the same pair, but the first sundered into two geographic races. I follow Wemple precisely in the circumscription of three entities, disagreeing only (apart from the generic question discussed above) in my disposition of *K. adenopoda* as a third variety of *D. pinnata* coordinate with var. *pinnata* and var. *trifoliata*. See further below, under var. *adenopoda*.

Key to the Varieties of *Dalea pinnata*

1. Primary cauline leaves with 2–5 (6) pairs of leaflets, these variable in width.
   2. Leaflets and their rachis very narrow, vermiform, the leaflets almost always closely involute and 0.3–0.6 (exceptionally expanded and up to 1) mm wide; *wing-* and *keel-petals* 3.7–4.5 mm long, commonly acute; *stems* microtuberculate under the spikes; *involucre* at anthesis mostly 6–9 (10) mm diam.
      52a. var. *pinnata*.
   2. Leaflets and their rachis broader, the leaflets elliptic-oblanceolate, flat or loosely folded, 1–2 mm wide; *wing-* and *keel-petals* 4.3–6 mm long, commonly obtuse or emarginate at apex; *stems* coarsely and prominently tuberculate under the heads; *involucre* at anthesis mostly 10–13 (14) mm diam.
      52c. var. *adenopoda*.
1. Primary cauline leaves all 3-foliolate, the leaflets always of the narrow, involute-vermiform type; *wing-* and *keel-petals* 4.8–6.8 mm long, but subacute; *involucre* of var. *pinnata*.
   52b. var. *trifoliata*.

52a. DALEA PINNATA (J. F. Gmelin) Barneby var. PINNATA
(Plate LXI)

Characters as given in key; 2n = 14 (Wemple, 1970, p. 12). — Collections: 32 (o, sed v. v.).

Dry pine woodland, commonly in white sand, widespread and locally plentiful from centr. peninsular Florida n. on the Atlantic Coastal Plain through s. and e. Georgia to s.-e. North Carolina, in Florida extending w. to the Gulf Coast in Franklin County, s. almost to Lake Okeechobee, in North Carolina n.-e. to Lenoir County; cf. Wemple, 1970, map 1. — Flowering September into early winter, hence called *Summer-farewell*. — *Representative*: NORTH CAROLINA: *Duke 2515* (UC); *Ahles 36,324* (NY). SOUTH CAROLINA: *Godfrey 8001* (NY, UC); *Fox & Godfrey 4260* (NY). GEORGIA: *Harper 1671* (NY); *Cronquist 4729* (NY, UC). FLORIDA: *Curtiss 571, 5307* (NY, UC); *Moldenke 192* (NY); *Rugel 169* (NY); *Tracy 7722* (NY, WIS).

Dalea pinnata (J. F. Gmelin) Barneby, comb. nov., based on *Kuhnia pinnata* (pinnate, of the leaves) J. F. Gmel., Syst. Nat. **2**(1): 375. 1791 (Sept-Nov, fide Stafleu, Taxon **12**: 62. 1963), based in turn on *Anonymos pinnata* Walter, Fl. Carol. 103. 1788, nom. illegit. — Holotypus, *Anonymos Kuhniae affinis*..., BM (herb. Walt.), not seen but verified by Wemple, 1970, p. 26. — *Kuhnistera caroliniensis* Lamk., Encycl. Méth. **3**(2): 370. 1892 (Feb 13, fide Stafleu, Taxon **12**: 68), also based on the last. *Dalea kuhnistera* (the generic name in apposition) Willd., Sp. Pl. **3**: 1337. 1802, an illegitimate change of epithet. *Petalostemon corymbosum* (corymbose, of the inflorescence) Michx., Fl. Bor. Amer. **2**: 50. 1803, another illegitimate substitute. *Psoralea corymbosa* (Michx.) Poir. in Lamk., Encycl. Méth. **5**: 694. 1804. *Dalea corymbosa* (Michx.) Poir., Dict. Sci. Nat. **12**: 462. 1818. *Kuhniastera pinnata* (Walt.) O. Kze., Rev. Gen. 192. 1891. *Petalostemon pinnatus* (J. F. Gmel.) Blake, Rhodora **17**: 131. 1915. *P. caroliniense* (Lamk.) Sprague, Kew Bull. **1939**: 331. 1939.

The commonest and most widespread form of Summer-farewell, collected first by Walter before 1788 and soon afterward by Michaux (P, herb. Michx!), through whom it reached the herbaria of Lamarck, Richard (P) and Willdenow (B). The pinnate leaves, mostly with three, four or five pairs of filiform, tightly involute leaflets are characteristic. Wemple (1970, p. 26) has mentioned a visually striking variant (*Young s. n.*, NY; *Rev. Hunt s. n.*, NY) from the Carolinas in which the leaflets are almost plane and hence appear relatively broad; I agree this is taxonomically insignificant. Plants of var. *pinnata* tend to have more elaborately and densely branched inflorescences than is usual in the very closely related var. *trifoliata*, but this is not a reliable differential character. The range of var. *pinnata*, as shown by Wemple's maps (1970), meets and slightly overlaps that of var. *trifoliata* in Georgia and western Florida, and that of var. *adenopoda* in central Florida, but I have seen no specimen of doubtful identity. In general the three entities conform to a vicariant pattern characteristic of geographical replacement series.

52b. DALEA PINNATA (J. F. Gmelin) Barneby var. TRIFOLIATA (Chapman) Barneby
(Plate LXI)

Characters as given in key; 2n = 14 (Wemple, 1970, p. 12). — Collections: 18 (o).

Sandy pinewoods and pine-palmetto savannahs, Gulf Coastal Plain w.-ward from lower Pearl River in extreme s.-e. Mississippi, s. Alabama, and the Florida Panhandle, thence n.-e. in scattered stations across centr. Georgia to the Savannah River near Augusta; cf. Wemple, 1970, map 1. — Flowering September–November. — *Representative*: MISSISSIPPI: *Pennell 4392* (NY). ALABAMA: *Mohr s. n.* (NY). FLORIDA: *Curtiss*

6934 (NY, UC); *Godfrey & Kral 54,174* (NY); *Chapman in Biltmore Herb. 818* (NY, UC). GEORGIA: *Eggleston 5106* (NY); *Cuthbert 189* (NY).

Dalea pinnata (J. F. Gmelin) var. **trifoliata** (Chapman) Barneby, comb. nov., based on *Petalostemon corymbosus* var. *trifoliatus* (3-leaved, meaning trifoliolate) Chapm., Fl. S. U. S. ed. 3, 101. 1897. — No typus or collector mentioned. — Lectotypus (Wemple, 1970, p. 28), *Biltmore Herb.* [*Chapman*] *6097* from Appalachicola, Fla., in Oct. 1897, US! — *Petalostemon pinnatum* ssp. *trifoliatum* (Chapm.) Wemple, Iowa State Jour. Sci. **45**(1): 27. 1970.

Gatesia alabamensis (of Alabama) Bertoloni, Miscell. Bot. fasc. 7: 31, tab. 1, fig. 1 a–c. 1848. — "Dr. Gates detexit in Alabama..." — Holotypus, formerly at BOLO, destroyed (fide Wemple, 1970); presumed isotypus, labelled "Alabama, *Dr. Gates*, 1831", NY (herb. Torr.)!

Essentially like var. *pinnata* except for the trifoil primary stem-leaves, slightly longer epistemonous petals, and often simpler mode of branching. Nomenclature apart, my concept is that of Wemple, 1970.

52c. DALEA PINNATA (J. F. Gmelin) Barneby var. ADENOPODA (Rydberg) Barneby (Plate LXI)

Characters as given in varietal key. — Collections: 10 (o).

Dry sandy openings and hillocks in oak-pine woodland, usually on the sterile white sands favored by *D. feayi, Ceratiola*, etc., reportedly not uncommon (but not much collected) in s. peninsular Florida, s. to the latitude of Fort Lauderdale, Broward County, n.-w. to Tampa and n. on the east side of the peninsula to Seminole County (and ? St. Augustine); cf. Wemple, 1970, map 1. — Flowering September to January (March). — *Representative*: *Small 9307* (NY); *Thorne 1265* (UC); *C. Hitchcock s. n.* (NY); *Small & Carter 1041* (NY).

Dalea pinnata (J. F. Gmel.) var. **adenopoda** (Rydb.) Barneby, stat. nov., based on *Kuhnistera adenopoda* (with gland-tuberculate stem) Rydb., N. Amer. Fl. **24**: 136. 1920. — "Type collected at Tampa, Florida, October, 1877, *A. P. Garber*..." — Holotypus, GH! isotypus, NY! — *Petalostemon adenopodum* (Rydb.) Wemple, Iowa State Jour. Sci. **45**(1): 23, fig. 6 (A–H). 1970. *P. corymbosum* var. *adenopodum* B. L. Robins. ex Rydb., N. Amer. Fl. **24**: 136, in syn., nomen.

Kuhnistera truncata (square-cut, of the epistemonous petals) Small, Bull. Torrey Club **51**: 381. 1924. — "The type specimens were collected at Earman, Florida, by Fannie C. Rane, March 2, 1921...also collected at Jupiter, Florida...by C. Hitchcock." — Holotypus, NY! paratypus (*Hitchcock*), cited above, NY!

The var. *adenopoda* suggests a generally coarsened form of var. *pinnata* in which the leaflets, involucre, and petals have all become proportionately broader and the glands, at least high on the stems, bigger and therefore more protuberant. The epistemonous petals are a little longer than those of var. *pinnata*, in the size-range of var. *trifoliata*, but obtuse. My concept of the entity is in no way different from *P. adenopodum* Wemple except that I interpret it, laying stress on similarities rather than differences, as a geographic subspecies of *D. pinnata* rather than as an autonomous species. The ranges of the two are for the most part distinct, a line drawn east and west through the peninsula in the latitude of Tampa separating most known stations of each. If the doubtful records (Mary Reynolds) from St. Augustine are disregarded the zone of overlap is hardly greater than that between var. *pinnata* and var. *trifoliolata*, and the morphological discontinuity is, in my opinion, hardly wider. The calyx of all forms of *D. pinnata* is the same.

IIID. Sectio Elaspora Barneby

Perennial herbs, psammophytes, with decumbent, branched stems arising from the buried crown of an orange taproot; *leaflets* mostly 4–7 pairs, commonly obovate-emarginate; *spikes* loose, narrow, the broad, herbaceous bracts persistent, charged with a few large blister-glands; *calyx-teeth* as long as or shorter than the tube; *petals* magenta-purple, concolorous, usually gland-tipped; *banner* with linear claw and peltate blade recessed at junction of claw into a cornet; *epistemonous petals* small, free, short-clawed, perched about half-way between hypanthium and anthers, well below the separation of the short filament-tassel, displayed obliquely horizontal to the long axis of the flower, caducous; *pod* obliquely half-obovate, the dorsal suture concave. — Monotypic, of centr. and s.-w. United States and n. Mexico.

Dalea subgen. **Dalea** sect. **Elaspora** Barneby, nom. et stat. nov., based on *Parosela* subgen. *Euparosela* XXVI. *Arenariae* Rydb., N. Amer. Fl. **24**: 92. 1920. — Sp. typica: *Parosela lanata* (Spreng.) Britt. = **Dalea lanata** Spreng. var. **lanata**.

53. Dalea lanata Sprengel

(Plate LXII)

Prostrate perennial herbs from a deeply penetrating, orange-yellow taproot, the 1–few stems (2.5) 3–7 dm long, divaricately branching upward from near the base, the spikes mostly incurved to vertical and appearing leaf-opposed, the subterete, sparsely or obsoletely punctate or verruculose stems greenish-stramineous, varying like the foliage from densely pilosulous to glabrous, the foliage silky-cinereous to dark green, the leaflets prominently punctate or gland-pustulate dorsally; *leaf-spurs* almost 0; *stipules* narrowly triangular-subulate to almost linear, submembranous, 1–2.5 mm long, stramineous becoming dry and deciduous, often charged with one or more large glands; *intrapetiolular glands* 0; *post-petiolular glands* large, prominent, orange or yellow; *leaves* all shortly petioled or all subsessile, 1–3 cm long, with margined rachis and (in main cauline ones) 4–7 pairs of obovate, obovate-cuneate, or broadly oblanceolate, mostly emarginate, sometimes truncate or very obtuse, flat or loosely folded, dorsally keeled leaflets 3–10 (12) mm long, charged at or just behind the tip with a prominent gland; *peduncles* 4–40 mm long; *spikes* loose and narrow, the flowers when pressed appearing ± 3-ranked, without petals or androecia 6–8 mm diam, the axis becoming (1) 1.5–7.5 (9) cm long; *bracts* persistent, herbaceous, broadly ovate- or obovate-acuminate or -apiculate, charged dorsally with at least 1, usually several very large, orange or castaneous blister-glands; *calyx* 3.3–4.5 (4.8) mm long, the submembranous, pallid or stramineous, bluntly angulate tube 1.8–2.5 mm long, the subconcolorous ribs immersed or nearly so, the intervals charged with 1 row of 1–4 small pallid glands (sometimes only distally), the teeth varying from lanceolate to broadly ovate or deltate-acuminate, (1.3) 1.5–2.3 mm long, as long to 0.9 mm shorter than the tube; *petals* bright red-violet or magenta-purple, all usually (but not always) prominently gland-tipped, the banner not or not much longer than the tiny, caducous epistemonous petals, these all free; *banner* 2.8–4.3 mm long, the claw 1–2 mm, the ovate-cordate to ± hastate and cucullate blade 1.8–3.1 mm long, 1.8–2.8 mm wide, its basal lobes united across the top of the claw to form a shallowly recessed cornet; *wing-* and *keel-petals* 2.2–4.3 mm long, the claw 0.2–0.8 mm long, basal or lateral to the oblong-elliptic to obovate, ovate, or suborbicular blades, these

(sometimes all dissimilar in 1 flower, those of the keel often a trifle larger) 2–3.8 mm long, 1.5–2.2 mm wide; *androecium* 8–10-merous, sometimes functionally 5-merous with barren or vestigial intervening filaments, 6.5–8.5 mm long, the filaments separated for ± 1.9–2.9 mm; *pod* obliquely deltate-obovate in profile, 2.5–3.1 mm long, the ventral suture concave, the strongly convex dorsal filiform, the valves at obconic base hyaline glabrous, thence thinly papery, pilosulous, charged with small scattered glands; *seed* ochraceous, olivaceous, or brown, smooth and sublustrous, 1.8–2.3 mm long.

Disregarding the very distinct, pentandrous *Dalea scariosa*, Rydberg's *Arenariae* can readily be accomodated within the span of one species, variable in pubescence and minor characters of the calyx, but otherwise virtually uniform. Two geographical races can be distinguished.

Key to the Varieties of *Dalea lanata*

1. Calyx villosulous from base upward, its dorsal and lateral teeth triangular to lanceolate; Pecos Valley in New Mexico to e. Colorado, n.-w. Arkansas, and s. Texas. 53a. var. *lanata*.
1. Calyx-tube glabrous or nearly so, but the teeth villosulous, these deltate- to ovate-acuminate or -apiculate, exceptionally glabrous throughout; Rio Grande Valley in New Mexico to trans-Pecos Texas, n. Coahuila and Chihuahua, w. through n.-w. New Mexico to the Colorado drainage in n. Arizona, s.-e. Utah, and extreme s.-w. Colorado. 53b. var. *terminalis*.

53a. DALEA LANATA Sprengel var. LANATA
(Plate LXII)

Stems commonly glandless or nearly so; *vesture* of stems and leaves always dense, relatively long, the longer hairs (often on the upper leaf-surface) up to 0.3–0.7 mm long; *calyx-tube* 2.2–2.5 mm, the longest (dorsal) tooth 1.5–2.1 (2.3) mm long; *petals* relatively large, the blades of the epistemonous ones 2.8–3.8 mm long; 2n = 14 (Mosquin). — Collections: 49 (iv).

Deep sandy soils, usually on hummocked dunes or drift-sand plains, near sea-level in s. Texas up to ± 1260 m (4200 ft) in the interior, forming extensive colonies but local and discontinuous, Pecos Valley in s.-e. New Mexico n. to the upper Canadian, Cimarron, and Arkansas rivers in s.-e. Colorado, s.-w. Kansas, and the Oklahoma Panhandle, downstream interruptedly along the Arkansas to Pulaski County, Arkansas, and e. in Texas through the Panhandle and Red River drainage to the upper Brazos and Trinity valleys in n.-centr. Texas; one old record from the North Platte in n.-e. Colorado (*Dr. James*); disjunctly on the Gulf Coastal Plain, in sandy live-oak woodland, in Kenedy, Brooks, Jim Hogg, and Starr counties, s. Texas. — Flowering in spring and summer n.-ward, intermittently through the fall s.-ward. — *Representative*: COLORADO: *W. A. Weber 5141*. NEW MEXICO: *Fendler 128* (NY, UC); *Ripley & Barneby 13,817* (CAS, NY, US); *Mosquin et al. 6938* (DAO, NY). KANSAS: *Rose & Fitch 17,033* (NY, US); *Rydberg & Imler 780* (NY), *925* (NY). OKLAHOMA: *G. W. Stevens 1680* (NY); *Goodman & Kelting 5331* (NY). ARKANSAS: *Demaree 8697, 8724* (NY). TEXAS: *McVaugh 7253* (NY); *Lundell 13,068* (NY, UC); *Hinckley 3070* (NY); *D. & H. Correll 10,661, 33,014* (RENNER).

Dalea lanata (woolly) Spreng., Syst. Veg. **3**: 327. 1826. — "Ad fl. Arkansa Amer. bor." — No typus known to survive, and no collector mentioned in the protologue, but from the circumstances and date certainly described from an isotypus of the next, sent to Sprengel by Nuttall. — *Parosela lanata* (Spreng.) Britt., Mem. Torrey Club **5**: 196. 1894.

Dalea lanuginosa (woolly) Nutt. ex T. & G., Fl. N. Amer. **1**: 307. 1838. "Gravelly banks and islands of the Arkansas, near Fort Smith, *Nuttall*! On the Platte, *D. James*!" — Holotypus, "*Dalea* **lanuginosa*. Arkansa. Nuttall," BM! isotypi, GH, NY (2 sheets, one ex herb. Torr., one a dupl. ex herb. Nutt. BM)! paratypus (*James*), NY!

This is a graceful but not a showy plant, found only on dunes or deep sandy soils, sometimes associated northward with *D. villosa* and on the coastal plain of Texas with *D. obovata* and *D. aurea*. It has a characteristic habit, the solitary or few stems branching as they rise from the sand into openly fanshaped sprays of gray or silvery foliage, the leaves all displayed so as to face the zenith. The flowers are vivid in hue but small and fugitive; few open at any one day, and their little epistemonous petals, best seen in the early hours, fall from their high perch on the androecium a few hours after the column expands. The flower suggests, except for the free keel-petals standing below the exposed tassel of golden anthers, that of several Mexican species of *Marina*, but the sessile calyx, paired ovules, and chromosome number are all in accord with *Dalea*.

The range of var. *lanata* is notably discontinuous, like that of *Astragalus ceramicus* Sheld. patterned and limited by the selective dune habitat. There seem to be no modern collections from north of the Arkansas River in western Kansas and the head of the Cimarron in s.-e. Colorado, nothing to confirm Dr. James's discovery on the South Platte in 1820. The stations in the state of Arkansas are situated directly on the eponymous river where the species is most probably an old immigrant, water-borne from upstream. The populations isolated out on the Coastal Plain in southern Texas seem not to differ in any appreciable way.

53b. DALEA LANATA Sprengel var. TERMINALIS (Jones) Barneby
(Plate LXII)

Stems rarely glandless, although only with a few scattered glands and these often concealed by vesture; *vesture* on the average a little shorter than in var. *lanata*, the longest hairs up to 0.2–0.45 (0.55) mm long, sometimes very sparse or, very locally, quite lacking and the plant glabrous throughout; *calyx-tube* 1.8–2.5 mm long, the longest tooth (1.3) 1.5–2.3 mm long; *petals* a trifle smaller than those of var. *lanata*, the blades of the epistemonous ones 2–3.4 mm long, 1.5–2 mm wide; n = 7 (Spellenberg, 1973); 2n = 14 (Mosquin). — Collections: 56 (v).

Dunes and drift-sand on open plains, 930–1860 m (3100–6200 ft), locally abundant, very common along the Rio Grande Valley from Sandoval County, New Mexico, downstream to the Big Bend in Trans-Pecos Texas, n.-w. in New Mexico across the Puerco-Colorado divide to the Four Corners country in s.-w. Colorado and adjoining Utah and Arizona, extending thence through the Little Colorado valley to its confluence with the Colorado in Coconino County, Arizona; Virgin valley in s.-w. Utah (Washington Co.) and adjacent Arizona (Beaverdam); from the Rio Grande extending s. into the great dunes of northern Chihuahua (50–60 km s. of El Paso-Juárez) and, perhaps isolated, to the e. margin of Bolsón de Mapimí in w.-centr. Coahuila (Sierra del Rey, near 27° N). — Flowering July to October, rarely earlier and sporadically later. — *Representative*: UNITED STATES. UTAH: *Holmgren 3799* (NY, UC). COLORADO: *Brandegee 1090* (NY, UC). ARIZONA: *Eastwood & Howell 6466* (CAS, UC); *Beasley 890* (NY); *Barneby 5037* (NY). NEW MEXICO: *Heller 15,797* (NY, UC);

A. Nelson 11,724 (NY, UC); *McClintock & Robbins 6445* (NY, UC); *Barneby 13,841* (CAS, NY), *13,849* (DAO, NY). TEXAS: *Hinckley 3513* (NY); *Warnock 5758, 13,672* (RENNER). MEXICO. CHIHUAHUA: *Gentry 8203* (UC); *Thurber 727* (F, NY). COAHUILA: *Purpus 4490* (F, UC).

Dalea lanata Spreng. var. **terminalis** (Jones) Barneby, comb. nov., based on *D. terminalis* Jones, Contrib. West. Bot. **12**: 8. 1908. — "Common at El Paso, Texas...also Albuquerque...Also at Billing." — Lectotypus, collected by Marcus E. Jones at El Paso, 10 Sept 1884, POM (2 sheets)! paratypi, as indicated, POM! — *Parosela terminalis* (Jones) A. Heller, Muhlenbergia **6**: 96. 1910.

Dalea glaberrima (quite hairless) Wats., Proc. Amer. Acad. **22**: 470. 1887. — "On sandhills, 30 or 40 miles south of Paso del Norte, Chihuahua (*C. G. Pringle*, September, 1886)." — Holotypus, *Pringle 720*, GH! isotypus, US! *Parosela glaberrima* (Wats.) Rose, Contrib. U. S. Nat. Herb. **10**: 103. 1906.

Dalea arenaria (of sands) Jones, Contrib. West. Bot. **12**: 8. 1908. — "...at Sapio and Sabinal, Chihuahua, Mex...Sept. 10 and 20, 1903." — Lectotypus, collected by Marcus E. Jones at "Sapio" [probably = Sapello], 10 Sept 1903, POM (2 sheets)! isotypus, US! paratypus, from Sabinal, 29 Sept 1903, POM!

Parosela subvillosa (somewhat pubescent) Rydb. in N. Amer. Fl. **24**: 93. 1920. — "Type collected on sand near Paso del Norte, Chihuahua, September 23, 1886, *Pringle 720*, in part (herb. Columbia Univ.)." — Holotypus, NY! isotypus, US! *Dalea subvillosa* (Rydb.) B. L. Turner, Field & Lab. **18**: 46. 1950.

In general habit and appearance the common, gray-leaved form of var. *terminalis* is indistinguishable from var. *lanata*, the differential characters in form and vesture of the calyx requiring close scrutiny. In practice little difficulty is anticipated, the ranges of the two varieties, where they most nearly approach each other, being separated both in New Mexico and in trans-Pecos Texas by the Pecos-Rio Grande divide. I have seen only one morphologically intermediate specimen, *H. & D. Correll 30,629* (RENNER) from the Rio Grande canyon in Brewster County; this combines the deltate calyx-teeth of var. *terminalis*, to which I refer it, with a pubescent calyx-tube. In Mesilla Valley between Las Cruces and Ciudad Juárez, and on dunes associated with the *bolsones* of Lago Guzmán and other interior basins of adjoining northern Chihuahua, there occurs with the ordinary gray-villosulous form a plant with glabrescent or even quite glabrous stems and foliage, the *Parosela glaberrima* of Rydberg's revision. Although very striking because of its rich green leaves, *P. glaberrima* differs from typical var. *terminalis* only in the loss of pubescence. This form was collected in October, 1852, by George Thurber, at Los Médanos, the great area of dunes lying about 60 km south of Ciudad Juárez, but his specimens (*no. 727*, F, GH, NY) attracted no particular attention. It was found next in 1886, in the same area, by Pringle, and in 1908, at points shortly to the west and northwest, by M. E. Jones; their collections furnished the types of *D. glaberrima* Wats. and *D. arenaria* Jones, respectively. Watson misinterpreted Pringle's plant as an erect shrub related to what is called in this revision *D. bicolor*; this, I suspect, explains Jones's duplication. Several collectors have found the glabrous and pubescent phases growing together, Wooton at Mesilla, New Mexico (*Nos. 35*, glabrous, *41*, villous, both NY, UC), Correll & I. M. Johnston near the type-locality of *D. glaberrima* (carefully distinguished as *Nos. 20,322-A*, glabrous, *20,322-B*, villous, both RENNER). The typus of *P. subvillosa* from near El Paso represents a more or less intermediate, thinly pubescent phase. During the early stages of my study I annotated several sheets of the truly glabrous state as a variety of *D. lanata*, but as I have seen more material I have come to regard it as another instance of a phenomenon encountered repeatedly in Amorpheae, an abrupt loss or an abrupt acquisition of pubescence unrelated to any other variable feature. While the glabrous (or glabrescent) phases of var. *terminalis* occur only in a small part of the latter's range they have acquired no independent disper-

sal of their own; I therefore think them reasonably reduced to one taxon variable in this one respect.

The pubescent form of var. *terminalis* was collected first by Charles Wright in 1848, on the Rio Grande "60 miles below El Paso", that is in the vicinity of Fort Hancock, Brewster County, Texas, and again, at a place not recorded, in 1851 (*Nos. 128, 981,* both NY). These collections were identified by Gray as *D. lanata*.

IV. Subgenus PAROSELA (Cavanilles) Barneby

Epistemonous petals (nearly always) strongly auriculate at base of blade and the inner pair valvately coherent into a conventional keel, this commonly (but not in sects. *Prosalea* and *Viridalea*) enclosing the anthers; *flowers* either sessile or pedicellate; *androecium* mostly (9) 10-merous, shallowly cleft (except sect. *Prosalea*) into a short tassel; herbs (mostly perennial, a few monocarpic) and shrubs, sometimes arborescent; x = 7.

Dalea subgen. **Parosela** (Cav.) Barneby, stat. nov., based on *Parosela* Cav., Descr. Pl. 185. 1802. — Lectogeneritypus (Rydberg, 1928, p. 429): *P. mutabilis* (Cav.) Cav., based on *Psoralea mutabilis* Cav. = (syn. tax.) **Dalea obovatifolia** Ort. var. **obovatifolia**.

Parasella Cavanilles ex Steudel, Nom. ed 2, **1**: 480. 1840, sphalm.

Key to the Sections of Subgen. *Parosela*

1. Androecium exserted far beyond the keel-petals; *petals* (homochromous) either white or greenish-yellow.
   2. Epistemonous petals (white, like the banner) not or obscurely auriculate at base; *spikes* of flower amentlike, flexuous, paniculately disposed at tips of branches, the inflorescence suggesting *Eysenhardtia*; suffrutescent and arborescent; w. and s. Mexico, monotypic. IVA. Sect. *Prosalea* (p. 285)
   2. Epistemonous petals (greenish-yellow, like the banner) auriculate, as in sect. *Parosela*; prostrate perennial herbs with headlike *flower-spikes* terminating leafy branches; n.-w. Mexico, monotypic. IVB. Sect. *Viridalea* (p. 289)
1. Androecium contained within the keel (if slightly extruded, the petals purple).
   3. Ventral suture of pod not thickened distally (below the style-base), its leading edge (prow) filiform or if carinate then slender and simple; polymorphic, consisting of many series, tall and dwarf shrubs and herbs, occasionally arborescent, a few monocarpic or precociously flowering the first season; spp. 107, in the whole range of the genus s.-ward from s.-w. United States. IVC. Sect. *Parosela* (p. 291)
   3. Ventral suture of pod conspicuously thickened under the style-base, its leading edge (or prow, facing outward from orifice of fruiting calyx) either flat and corneous or strongly 2-carinate.
      4. Petals (of sect. Parosela) white or anthocyanic, never yellow; *bracts* of broad outline, broadly membranous-margined, permanently or (in monocarpic *D. foliolosa*) before anthesis clasping the calyx; *foliage* glabrous conspicuously gland-dotted; herbs, perennial or annual, of centr. and s.-w. United States, Mexico, and Central America, 1 adventive further s.: spp. 4. IVD. Sect. *Psoropogon* (p. 545)

4. Petals (variable in proportions) yellow, commonly fading brown or pinkish; *bracts* various, but lacking broad membranous margins; *foliage* pilose, not or only obscurely gland-dotted; perennial herbs, sometimes precociously flowering but never truly monocarpic, of the Mexican plateau and s.-w. and prairie United States; spp. 10.

IVE. Sect. *Clipogon* (p. 560)

IVA. Sectio PROSALEA Barneby

Epistemonous petals (white, like the banner) little oblique, the blades obscurely auriculate at base, resembling petals of subgen. *Dalea* sect. *Thornbera* except for the valvately coherent keel-petals; *banner-blade* plane and open at base; *androecium* cleft nearly half-way into a long tassel, the anthers at full anthesis exserted beyond keel. Shrubs and small trees, some flowering precociously as suffrutescent herbs, with narrow amentiform spikes arranged in terminal panicles (suggesting *Eysenhardtia* or *Amorpha*). — Sp. 1 (polymorphic), of w. and s. Mexico.

Dalea subgen. **Parosela** sect. **Prosalea** Barneby, nom. et stat. nov., based on *Parosela* subgen. *Euparosela* XXVIII *Eysenhardtioides* Rydb., N. Amer. Fl. **24**: 94. 1920. — Sp. lectotypica: *P. eysenhardtioides* (Hemsl.) Rose = **Dalea leucostachya** var. **eysenhardtioides** (Hemsl.) Barneby.

The sect. *Prosalea* is coextensive with and taxonomically equivalent to *Parosela* sect. *Eysenhardtioides* Rydb. The present treatment only differs from that in *North American Flora* insofar that Rydberg's two species are reevaluated, in the light of much more ample material, as geographic expressions of one.

In the context of subgen. *Parosela* this monotypic section appears unique in two features: the arrangement of the flower-spikes and the proportions of the flower-parts. The panicle of narrow, often flexuous, catkin-like spikes (Pl. LXIII), characteristic of the group though it be, is not fundamentally different from the looser, corymbose or paniculate branching-patterns of the average shrubby member of sect. *Parosela*. In the latter, floriferous branches arising below the terminal-central spike of a given stem consist of two to many developed internodes, each marked off by a leaf (sometimes diminished) or by stipular remnants of a leaf; and the spikes that terminate these are borne aloft to, or often beyond, the level of the larger central one. In sect. *Prosalea* each lateral branchlet is reduced to its terminal spike, and even the leaf suffulcrant to it is often suppressed, just as in the similar compound panicle of *Amorpha* or *Eysenhardtia*. The flower of sect. *Prosalea* is in some respects intermediate between those of subgenera *Dalea* (especially *D.* (*Thornbera*) *albiflora*) and *Parosela*, having the exserted, deeply cleft androecium of the former and the valvately united keel of the latter. The combination is not matched elsewhere in the genus and forms the signature of the section.

Relationships of *D. leucostachya* are not readily apparent. The calyx resembles that of *D.* (sect. *Parosela*) *tomentosa*, in which the lateral flowering branchlets are usually all abbreviated, yet still leafy, resulting in a narrow panicle that might be interpreted as precursor to that of sect. *Prosalea*. But the organization of the corolla of *D. tomentosa* is typical of sect. *Parosela* with a short, included filament-tassel.

Intraspecific variation in *D. leucostachya* is considerable and really not yet understood, no firm correlation between morphology and dispersal having been worked out. In the Neo-volcanic Belt and Sierra Madre del Sur pubescence of leaves and calyx is thin or

almost lacking, as are the axillary leafy spurs developed during late anthesis. In the same range the whole flower is on the average relatively small, and the mature plant forms a straggling shrub with one or several thin crooked trunks which may develop in age into a small tree up to 6 m tall. In Sierra Madre Occidental and southwest margin of the Meseta Central the largest plants attain the stature of bushy shrubs up to 2 m tall, with decidedly pubescent primary cauline leaves from the axils of which develop during or after anthesis densely tomentulose leafy spurs. In the same area the flower is usually a little larger and the calyx always puberulent externally. Northward the spikes lateral to the panicle are often accompanied by a developed leaf, whereas the whole panicle tends to be leafless southward. Most of the material examined can be sorted according to these differences into northern and southern races but Gentry collected on Río Mayo, at the northwestern limit of the species near the Chihuahua-Sonora boundary, specimens (*Gentry 2833*, ARIZ) which have all the supposed attributes of the southern var. *eysenhardtioides* (except possibly stature, essentially an expression of climate) although from a locality where only var. *leucostachya* could reasonably be expected. Most collections, however, from the west slope of Sierra Madre Occidental are in one or another feature intermediate between the two varieties.

According to Rydberg *P. eysenhardtioides* differed from *P. leucostachya* in longer, supposedly nodding flower-spikes and relatively longer calyx-teeth. These differences hold true only for selected extreme forms, the spikes becoming shorter in the thrifty plant of arid rocky slopes on the east piedmont of Sierra Madre, but not consistently so. Calyx-teeth ranging from 0.7 to 1.3 mm are found through the whole species-range.

Gentry noted that in Chihuahua and Sonora *D. leucostachya* is visited by Hymenoptera, Sphecidae, and Pepsis, and I have myself seen in Sinaloa and Zacatecas (var. *leucostachya*) and in Michoacán (var. *eysenhardtioides*) clouds of butterflies, bees and small flies hovering over the bushes in flower, much as they do over the white prairie-clover (*D. candida*) in central United States. The abundant golden pollen, freely offered, and perhaps a little nectar, provide the lure.

54. Dalea leucostachya Gray
(Plate LXIII)

Bushy shrubs of rounded outline, northward flowering as suffrutescent herbs and southward becoming tall straggling shrubs with thin naked trunks or (when old) small trees, fertile at stature of 0.4–6 m, varying from nearly glabrous to densely pilosulous or tomentulose almost throughout, the young branches pliant, freely forking, going out into ± pyramidal or corymbiform, leafless or sparsely leafy panicles of flexuous, catkin-like spikes; *leaf-spurs* 0.5–1 mm long; *stipules* deltate to subulate or lance-caudate, 1–3.5 mm long, becoming dry, fragile, and often easily rubbed off; *intrapetiolular glands* usually setiform, sometimes minute; *post-petiolular glands* prominent; *main cauline leaves* 2.5–9.5 cm long, shortly petioled, the rachis margined, shallowly grooved ventrally, punctate, the leaflets 3–7 pairs, oblanceolate to obovate, obovate-cuneate, or elliptic, emarginate to short-acuminate or obtuse and gland-mucronulate, flat or nearly so, (0.8) 1–2.5 (3) cm long, keeled dorsally, the leaves high on young fertile branchlets and leaves of axillary spurs developing contemporaneously with and after anthesis often smaller, with fewer and shorter, sometimes more densely pubescent leaflets; *peduncles* 0–3 cm long; *spikes* loosely and narrowly many-flowered, the flowers 2- or loosely 3-ranked when pressed, without petals 5–7.5 mm diam, the pilosulous axis (1) 1.5–8 cm, that of the central-terminal spike usually at least 3 cm long; *bracts* deciduous, ovate- or lance-acuminate, 1.2–2.5 mm long, sub-

membranous, brown or purplish, dorsally pilosulous or puberulent, sparsely glandular; *calyx* 2.1–4 mm long, either puberulent to pilosulous externally from base upward or glabrous externally below the teeth, the tube 1.7–2.5 mm long, pleated when mature, the ribs prominent, castaneous or livid, the pale, submembranous intervals charged with 1 row of conspicuous or sometimes minute and colorless glands, the deltate to triangular teeth 0.4–1.5 mm long, commonly brown or nigrescent; *petals* white, the banner sometimes faintly rubescent, the wings and keel inserted below middle of androecium, the keel-petals united by their external edges but shorter than the stamens; *banner* 4.5–7.2 mm long, the claw 1.5–3.2 mm, the ovate-cordate, nearly erect blade 2.6–4 mm long, 2.4–4.4 mm wide; *wings* 3.4–7 mm long, the claws 0.7–2 mm, the elliptic or oblong blades not strongly auriculate, 2.7–5.3 mm long, 1.2–3 mm wide; *keel* 3.2–7.7 mm long, the claws 0.7–3 mm, the oblong-elliptic blades 2.7–5 mm long, 1.1–2.8 mm wide; *androecium* 10-merous, (4.5) 5–7.5 mm long, cleft ± half-way into a long tassel, the connective gland-tipped, the anthers golden-yellow, 0.4–0.7 mm long; *pod* in profile subaequilaterally triangular, ± 2–2.3 mm long, the style-base asymmetrically terminal, the sutures subfiliform, the valves very thin, green, at base glabrate, sprinkled with minute golden glands, pilosulous at tip; *seed* 1.1–1.4 mm long.

Key to the Varieties of *Dalea leucostachya*

1. Main cauline leaves glabrous or thinly puberulent, not subtending tomentulose axillary branchlets; flower small, with glabrous or glabrate calyx-tube and keel only 3.2–5.4 mm, its blades 2.7–3.9 mm long, 1.1–1.8 mm wide; s. Mexico, along the Neo-volcanic Range and Sierra Madre del Sur from Tepic (Cerro San Juan) and w. Jalisco (Sierra del Cuale) e. and s.-e. to s.-w. México and Oaxaca; disjunct in w. Chihuahua (Río Mayo). 54a. var. *eysenhardtioides*.
1. Main cauline leaves pilosulous or tomentulose but greenish, pubescent at least below, often both sides, and subtending (during or after anthesis) densely tomentulose leafy spurs; flower larger, the calyx-tube pilosulous externally, the keel 5–7.7 mm, its blades 3.4–5 mm long, 1.5–2.8 mm wide; w. Mexico, on both slopes of Sierra Madre Occidental and adjoining plateau, s.-e. Sonora and centr. Chihuahua to extreme w. Zacatecas, n. Jalisco, and Sinaloa. 54b. var. *leucostachya*.

54a. DALEA LEUCOSTACHYA Gray var. EYSENHARDTIOIDES (Hemsley) Barneby (Plate LXIII)

Maturing as a straggling shrub with crooked leafless trunks or single-stemmed treelet up to 2–6 m tall, but flowering precociously when suffrutescent; *foliage* (especially associated with inflorescences) glabrous or glabrescent, green, the leaflets always glabrous above, sometimes both sides; *panicle* of spikes commonly leafless; n = 7 (Spellenberg). — Collections: 25 (i).

Pine-forest and mixed oak-pine woodlands, descending atypically into thorn-forest, (610) 900–2650 m (± 2000–8300 ft), locally abundant, Neo-volcanic range of s. Mexico from Cerro San Juan, Nayarit, and Sierra del Cuale, w. Jalisco e. and s.-e. to s.-w. México and along Sierra Madre del Sur into Oaxaca; disjunctly in w. Chihuahua (Río Mayo). — Flowering September to February. — *Representative*: NAYARIT. Jalisco: Cerro San Juan, *Mexia 688* (NY). JALISCO. Talpa de Allende: Sa. del Cuale, *McVaugh*

14,356 (MEXU, MICH); Mascota: Sa. La Campana, *McVaugh 13,706* (MEXU, MICH). Amacueca: road to Tapalpa, *McVaugh 20,666* (MICH). ——— : Volcán and Nevado de Colima, *Villareal de Puga 120* (ENCB), *McVaugh 13,435* (MEXU, MICH). MICHOACÁN. Tancítaro: Tancítaro, *Hinton 15,554* (ARIZ); Uruapan: Tarascón, *Pringle 10,119* (ARIZ, F, L, M, MEXU, NY, OK, UC, US, W, Z); w. of Uruapan, *Ripley & Barneby 14,834* (CAS, DAO, MEXU, NY, US); Coalcomán: Sa. Torrecillas, *Hinton 12,777* (BR, F, NY, UC). GUERRERO. Chichihualco: Cruz de Ocote, w.-s.-w. of Camotlán, *Rzedowski 18,106* (ENCB). MÉXICO. Sultepec: Sultepec, *Matuda 26,448* (MEXU, NY); Temascaltepec: Bejucos, *Hinton 2007* (F, MEXU, NY, Z). OAXACA. Sierra Madre del Sur, *Galeotti* (type of *D. eysenhardtioides*); s. loc., *Ghiesbreght 268* in 1844 (P). CHIHUAHUA. Uruáchic: Batopilillas, *Gentry 2838* (ARIZ).

Dalea leucostachya Gray var. **eysenhardtioides** (Hemsl.) Barneby, Phytologia **26**: 1. 1973, based on *D. eysenhardtioides* (resembling *Eysenhardtia* in the panicle of small white flowers) Hemsl., Diag. Pl. Nov. 6. 1878. — "Mexico: in montibus Oaxacae prope Mare Pacificum, alt. 4000–7000 ped., *Galeotti*, 7013..." — Holotypus, dated 1840, K! isotypi, BR (herb. Galeott., herb. Mart.), P! — *Parosela eysenhardtioides* (Hemsl.) Rose, Contrib. U. S. Nat. Herb. **10**: 104. 1910.

This form of *D. leucostachya* was collected first by Sessé and Mociño (*Herb. S. & M. 2681*, MA) and was possibly described by them as *Psoralea fruticosa* (Pl. Nov. Hisp. 121. 1889), but the identification is far from certain.

54b. DALEA LEUCOSTACHYA Gray var. LEUCOSTACHYA

(Plate LXIII)

Maturing as a rounded, many-stemmed shrub up to ± 2 m diam, but sometimes flowering first as a weakly suffrutescent herb; *foliage* and stems usually pilosulous throughout, the leaflets of main cauline leaves sometimes glabrous above; *panicle* of spikes usually with some developed leaves subtending lower spikes, sometimes leafless; $2n = 7_{II}$ (Mosquin). — Collections: 17 (ii).

Rocky and brushy hillsides in the oak-belt, coming out into arid grassland and thorn-forest, ± 1300–2100 m (4330–7000 ft), locally plentiful but scattered, Sierra Madre Occidental on the w. slope from valley of Río Mayo in s. Sonora and adjoining Chihuahua to s. Sinaloa, and on the e. slope and adjoining mountainous margin of Meseta Central from centr. Chihuahua to w. Zacatecas; barranca of Río Grande de Santiago near Guadalajara, Jalisco. — Flowering August to January. — *Representative*: SONORA. Alamos: Sa. Charuco, *Gentry 1699* (ARIZ, F, MEXU, UC). CHIHUAHUA. Chínipas: Sa. Canelo, *Gentry 2860* (ARIZ, F, MEXU, UC); Balleza: Guasarachí, *Goldman 148* (GH, US); Chihuahua: Sa. de Mápula, *Pringle 721* (BR, F, NY, MEXU, UC, W). DURANGO. Santiago Papasquiaro: 8 mi. s.-w. of Santiago, *Mosquin et al 6888* (NY); Durango: Durango, *Palmer 614* (C, F, NY, UC, US). SINALOA. Badariguato: Sa. Surutato, *Breedlove & Kanahara 16833* (CAS); Concordia: Palmito, *Ripley & Barneby 14,017* (CAS, NY, US). ZACATECAS. Sombrerete: Sa. Papantón, *Ripley & Barneby 14,155* (CAS, MEXU, NY, US). JALISCO. Guadalajara: La Barranca, *Pringle 7329* (NY).

Dalea leucostachya Gray var. **leucostachya**. *D. leucostachya* (with white spikes) Gray, Mem. Amer. Acad. II, **4** (Pl. Wright. **1**): 32. 1849 ("*leucostachys*"). — "At Cosiquiriachi, in the Sierra Madre [= Cusihuiriachic, ± 85 km airline s.-w. of Ciudad Chihuahua],

Dr. Wislizenus." — Holotypus, GH! — *Parosela leucostachys* (Gray) Rose, Contrib. U. S. Nat. Herb. **10**: 104. 1906.

Dalea decipiens (deceptive) M. E. Jones, Extr. from Contrib. West. Bot. **18**: 43. 1933 (cf. Morton, Contrib. U. S. Nat. Herb. **29**: 102. 1945). — "No. 27229, from La Barranca [near Guadalajara, Jalisco], Nov. 23 1930." — Holotypus, POM! isotypi, NY, UC, US!

IVB. Sectio VIRIDALEA Barneby

Epistemonous petals (greenish-yellow, like the banner) of subgen. *Parosela*, the keel-blades valvately coherent by their exterior edges, but the *androecium* far exserted, cleft distally into a long tassel; *banner* a trifle longer than the detached keel, its blade open ventrally at base. Prostrate perennial herbs, almost glabrous, with habit and tumid, glossily membranous, gross-glandular calyx of sect. *Parosela* ser. *Lasiostomae*. — Sp. 1, of grama grasslands on higher w. half of Mexican Plateau.

Dalea subgen. **Parosela** sect. **Viridalea** Barneby, subgen. nov., inter omnes affines androecio longe exserto petalisque citrino-viridescentibus praestans. — Sp. unica: **D. viridiflora** Wats.

The curious, taxonomically isolated *D. viridiflora* was associated by Rydberg (1919, p. 57) with *D. hegewischiana* and because the latter, but not *D. viridiflora* itself, has pedicelled flowers, the pair were transferred from among their natural allies to Rydberg's *Parosela* subgen. *Trichopodium*, essentially equivalent to genus *Marina* of this account. In subgen. *Trichopodium* they formed with *Psorothamnus thompsonae* an artificial triad characterized by a calyx at once short-toothed, glossily membranous below the teeth, and decorated with exceptionally large, jewel-like blister-glands; in floral structure they have little in common. In habit of growth *D. viridiflora* certainly resembles *D. hegewischiana* (Pl. LXV) closely, and they may well be derived from common ancestors. However the plane banner, longer than the detached keel, the strange flower-color, and the long-exserted but only shortly cleft tassel of stamens are so highly modified as to entitle *D. viridiflora* to the status of discrete section in subgen. *Parosela*. Another suggestive similarity can be visualized at Pl. XL, where *D. viridiflora* is paired with the also taxonomically isolated *D. rubrolutea*. This latter, while fundamentally different in its free high-perching keel-petals and for this reason referred to subgen. *Dalea*, is apparently not unlike *D. viridiflora* in gross appearance, and has also a glossy, short-toothed calyx, concolorous yellowish gland-tipped petals, and an exserted (but proportionately more deeply cleft) tassel of filaments.

55. DALEA VIRIDIFLORA Watson

(Plate XL)

Humifuse perennial herbs from a tough taproot and short caudex, glabrous except for ciliolate orifice of the calyx and ovary, the slender, pliantly flexuous, striate, stramineous or purplish, prominently and densely gland-tuberculate stems (2) 2.5–8 (10) dm long, usually forking both near the base and again above the middle, the intervening nodes usually giving rise to short sterile spurs, together forming circular mats of foliage floriferous about the circumference, the spikes terminal to the primary axis and 1–4 lateral branches of each stem; *leaf-spurs* 0.4–1 mm long; *stipules* linear- to narrowly lance-acuminate or subsetiform, 1.3–4 mm long, commonly brownish or livid, finally dry and fragile; *intrapetiolular gland* 1, prominent; *post-petiolular glands* large, conic; *leaves* shortly petioled, the main cauline ones 1.2–3 (3.5) cm long, with

narrowly margined, remotely punctate rachis and 7–11 pairs of obovate, oblong-obovate, obovate-cuneate, or broadly oblanceolate, truncate-emarginate, flat or loosely folded leaflets 2–4 mm long, pale green above, glaucescent and punctate beneath, the leaves of spurs and basal innovations smaller, with fewer leaflets; *peduncles* 0.5–4 cm long; *spikes* moderately dense, ovoid becoming oblong-cylindroid, without petals 9.5–12 mm diam, the glabrous axis becoming 1.5–6 (7) cm long; *bracts* persistent until anthesis, the lowest sometimes permanently so (becoming dry and brownish), the interfloral ones lanceolate to elliptic-oblanceolate, 3–5 mm long, livid or livid-greenish above the pallid base, almost plane, charged dorsally with a few large glands; *pedicels* 0–0.3 mm long; *calyx* 4.2–5 mm long, ellipsoid becoming tumid, the tube (3) 3.3–4.1 mm long, finally 2.4–3 mm diam, stramineous except for the darker, filiform and immersed ribs, each interval charged with one large and often one smaller (superposed) gland, the sinuses all equally deep or the lateral ones slightly deeper than the rest, the white-ciliolate teeth broadly low-deltate 0.4–1 mm long, charged at apex with a ventral and 2 lateral gland-spurs; *petals* vivid yellow-green when fresh, often drying yellow, all charged near apex with a prominent blister-gland, the banner often with a crescent of small glands on blade, the epistemonous petals perched below middle of androecium (± 1.5–2 mm above hypanthium); *banner* (5) 5.2–6.5 mm long, the claw 2.7–3.6 mm, the ovate to deltate-ovate, often basally subcordate, apically emarginate blade 2.3–3.2 mm long, 2.4–3.5 (4) mm wide; *wings* 4.1–4.7 mm long, the claw 1–1.7 (1.9) mm, the oblong to ovate-oblong blade short-auriculate at base, 2.9–3.5 mm long, 1.1–1.5 mm wide; *keel* 4.6–5.3 mm long, the claws 1.4–2.1 mm, the obovate-oblong blades 3–3.8 mm long, 1.4–2 mm wide; *androecium* 10-merous, (6.7) 7–8.8 mm long, the longest filament free for 2.7–3.5 mm, the connective gland-tipped, the yellowish anthers 0.6–0.8 mm long; *pod* ± 2.5 mm long, triangular-obovate in profile, the style-base latero-terminal, the valves hyaline and glabrous in lower ⅔, pale green, gland-sprinkled and thinly pilosulous distally, finally dehiscent through ventral suture; *seed* ± 1.7 mm long; 2n = 14 (Mosquin). — Collections: 14 (v).

Stony hillsides, gullied bluffs, and open plains, 1680–2430 m (5600–8100 ft), local but forming colonies, in grassland along the e. piedmont of Sierra Madre Occidental and adjoining plateau, centr. Chihuahua s. to n.-w. Zacatecas. — Flowering September to November. — *Material*: CHIHUAHUA. Cuauhtémoc: 15 mi e. of San Antonio, *Mueller 3360* (UC); Aquiles Serdán: Potrero Mt., *Pringle 722* (BR, NY, UC, W); Villa Matamoros: 5 mi. n. of V. Matamoros, *Correll & Gentry 22,847* (RENNER); 11 mi s. of V. Matamoros, *Ripley & Barneby 13,941* (CAS, NY, US); Hidalgo del Parral: Parral, *E. W. Nelson 5004* (NY, US); Huejotitán: Parral to Huejotitán, *Ripley & Barneby 13,920* (MEXU, NY). DURANGO. Villa Ocampo: n.-e. of V. Ocampo, *Gentry 8653* (MEXU, UC); 12½ mi s.-e. of V. Ocampo, *Ripley & Barneby 13,946* (NY); Torreón de Canas, *Gentry 6958* (NY); Villa Hidalgo: 14 mi n.-w. of La Zarca, *G. N. Jones 22,913* (NY, WIS). ZACATECAS. Sombrerete: 2 mi e. of Sombrerete, *Ripley & Barneby 13,465* (CAS, K, NY, US); 6 mi e. of Sombrerete, *14,150* (CAS, NY); 9 mi e. of Sombrerete, *M. C. Johnston 2947* (TEX).

Dalea viridiflora (green-flowered) Wats., Proc. Amer. Acad. **21**: 448. 1886. — "Summit of the Santa Eulalia Mountains [= 20–25 km airline s.-e. of Ciudad Chihuahua]; C. G. Pringle, November, 1885 (n. 518)." — Holotypus, GH! — *Parosela viridiflora* (Wats.) Rose, Contrib. U. S. Nat. Herb. **8**: 305. 1905.

At anthesis the mature plant of *D. viridiflora* presents a cartwheel of slender prostrate delicately but densely leafy stems about 5–15 dm diameter bearing around its circum-

ference a ring of bottle-brush spikes held vertically on short, incurved footstalks. In habit it resembles *D. hegewischiana*, but the color and form of the flower are unique in *Dalea*, the tumid, lustrously membranous calyx, the vivid yellow-green petals all charged near the tip with a glowing blister-gland, and the protruding tassel of stamens contributing to its peculiar aspect. The externally glabrous, short-toothed calyx ciliolate around the mouth is similar to that of *D. frutescens, D. hospes,* and *D. hegewischiana*, but all of these have the banner shorter than the detached keel, and included stamens; the two first mentioned are, furthermore, erect and shrubby.

The range of *D. viridiflora* was traced by Rydberg (1919, p. 57) south into Hidalgo, but the record for this state was based on a form of *D. hegewischiana* (*Pringle 6934*), different not only in flower-structure but also in the relatively few (5–7) pairs of leaflets.

IVC. Sectio PAROSELA (Cavanilles) Barneby

Epistemonous petals (of subgen. *Parosela*) perched well below, at, or above middle of androecium, the keel at anthesis enclosing the shorter tassel of filaments and the anthers; *banner* either longer or shorter than the detached keel, its blade either plane and open at junction with claw, or its basal lobes folded onto and adherent to the ventral face forming on each side an extrorsely opening pocket, or thickened at base and recessed into an inversely conic depression or cornet; *pod* variable in outline from obliquely obovate to deltate, but its dorsal suture never dilated nor bicarinate under the style-base. — Herbs (annual, perennial) and shrubs, some attaining treelet stature; *leaves* pinnate (except in *D. eriophylla*, with palmately trifoliolate leaves and purple keel); inflorescence commonly spicate, some racemose, loose or dense, the bracts either deciduous or persistent; *calyx* in most ± pubescent, nearly always so around and within the symmetrical to highly oblique orifice, exceptionally glabrous, the teeth varying from low-deltate to long-aristate, from much shorter to much longer than tube; *perianth* bicolored or homochromous, the blade of banner commonly white to yellowish at early anthesis, then rubescent, the epistemonous petals (wholly or partly) blue, purple, or pink-lilac, rarely all purple, or all whitish, or all brownish-pink, in several series all yellow or greenish-white, then commonly fading brown, orange, or black. — Spp. 107, dispersed over the range of the genus s.-ward from s. Oklahoma, s.-e. Colorado, New Mexico, centr. Arizona, and n. Baja California, diverse and ubiquitous throughout the temperate and arid-tropical zones of Mexico and highland Central America, a few circum-Caribbean (one reaching s. peninsular Florida), and s. along the Andes at middle and high elevations from Colombia to n.-w. Argentina and n. Chile; one on Galápagos Is.

Dalea subgen. **Parosela** sect. **Parosela**. *Dalea* subgen. *Parosela* sens. str., q. v. supra. — Sp. typica: **D. obovatifolia** Ort.

The section *Parosela* is defined negatively as the residue following segregation from the homonymous subgenus of sects. *Prosalea* and *Viridalea*, notable for exserted androecia, and of sect. *Cylipogon*, in which yellow petals coincide with a modified pod and peculiar facies. With over 100 described species, the section now constitutes two thirds of the entire genus, and while uniform enough in basic floral morphology so as to be easily visualized and neatly defined, presents an almost inexhaustible store of variations on the sectional theme, variations involving duration, habit, foliage, pubescence, development of pedicels, mutual proportions of banner to keel, position of epistemonous petals in relation to the androecium, and coloring of the petals themselves. By means of these phenotypic characters, intuitively weighted, the species have been sorted into 29 series, many of which

correspond closely with groups already formulated by Rydberg (1919–20). It is believed that these series are end-products of a radially explosive, still continuing evolutionary process; as such they resist manipulation into a linear sequence imposed by the format of a book. The sequence adopted, a compromise between convenience and an imperfectly comprehended phylogeny, takes its rational basis from five criteria:

i. Racemose inflorescence precedes a spike.
ii. Short calyx-teeth precede long.
iii. Pink, purple, and blue epistemonous petals precede yellow ones.
iv. A banner longer than the detached keel (prevalent in subgen. *Dalea*) precedes one shorter. The flower with proportionately long banner is termed *vexillate*; the other *carinate*.
v. Blade of banner plane and unappendaged at base, not thickened there or recessed into a cornet, precedes one so modified.

Even casual scrutiny will show that the priorities are poorly correlated. For example a pedicel, well developed in several monotypic series with vexillate flower, forming an ostensibly primitive combination, coincides in the case of *D. melantha* with long-toothed calyx, yellow petals, and a carinate flower. Despite such dissonances and setbacks, a general progress can be discerned from prevailing short to prevailing long calyx-teeth and from a vexillate to a carinate flower. The order of presentation is modified so as to bring out ser. *Lasiostomae* as close as possible to its probable relative sect. *Viridalea*, and to bring ser. *Sericeae* out at the end, leading on to sect. *Cylipogon*. Annual species, it will be noticed, make independent appearances, having arisen, it seems, from several different evolutionary lines. Between the extremities, the 29 series fall into three major circles of affinity: ser. i–xii, with vexillate flower and plane banner common, long calyx-teeth exceptional, pedicels at first common, rare at end, and yellow petals obviously derived (in an Andean context); ser. xiii–xxiv, with carinate flower and modified banner dominant, a complete series of calyces from short (but seldom extremely short) to long-toothed, and yellow petals appearing independently at several points and becoming finally dominant; and ser. xxv–xxviii, again vexillate but with paradoxically long calyx-teeth, perhaps artificially divorced from the first circle, but the affinities controversial.

Key to the Series of Sect. *Parosela*

A. Key to series present in North America: immediately following.
B. Key to series present in South America: p. 300.

A. Series present in North America

1. Plants of West Indies, s. peninsular Florida, and Yucatan Peninsula in Mexico.
   xxv. *Thyrsiflorae* (p. 506)
1. Plants of s.-w. United States, Mexico except Yucatan Peninsula, and Central America.
   2. Plants of Baja California, all shrubs with bicolored flowers.
      3. Calyx-teeth up to 5–9.5 mm long, 1.5–3 times as long as tube; *leaflets* 3–7; *axis of spikes* persistent as a stout thorn.
         xxii. *Purpusianae* (p. 500)
      3. Calyx-teeth much shorter, at best only a trifle longer than tube; *leaflets* much more numerous; *axis of spikes* not persistent.
         xvi. *Tuberculatae* (p. 412)
   2. Plants of continental Mexico, United States, and Central America.
      4. Calyx pedicellate, even though only shortly so.

5. Stems densely charged with stalked, tack-shaped, black warts. Epistemonous petals blue, high-perching and short-clawed, the detached keel shorter than banner; s.-e. Mexico (Puebla, Oaxaca).
iv. *Asperatae* (p. 328)

5. Stems smooth, or if verruculose the glands or warts sub- or hemispherical to lenslike, neither stalked nor black.
6. Blade of banner charged dorsally just above claw with a small tuft of hairs; coarsely leafy, when adult shrubby plants of extreme s. Mexico (Chiapas) and centr. America, the larger leaflets up to 1–2 cm long.
7. Interfloral bracts persistent; *glands* in intercostal panels of calyx-tube few, subuniseriate; *petals* opening greenish-yellow (fading brownish); *leaflets* 5–10 pairs, green, glabrous or almost so.
vii. *Dispares* (p. 340)

7. Interfloral bracts deciduous by full anthesis; *glands* in panels of calyx-tube many, small, several-ranked or scattered; *petals* vivid blue except for partly white banner; *leaflets* 3–7 pairs, finely densely pubescent both sides. vi. *Dryophilae* (p. 338)

6. Blade of banner glabrous dorsally; shrubs and herbs variable in stature, if sympatric with the last with much smaller leaflets.
8. Leaflets at once linear and at least 1 cm long. Nueva Galicia.
64. *D. nemaphyllidia* (p. 319)

8. Leaflets either broader than linear or much shorter.
9. Calyx-tube hyaline between the ribs, externally glabrous or thinly pilosulous, the teeth all broad and short, the ventral pair wider than long. i. *Lasiostomae* (p. 302)

9. Calyx tube either firm or hyaline between ribs, if hyaline then densely pilose or pilosulous and the calyx-teeth all proportionately longer and narrower, triangular-subulate to aristiform. xxi. *Versicolores* (p. 459)

4. Calyx sessile.
10. Leaves all 3-foliolate; diminutive shrubs of arid n.-e. Mexico.
xx. *Eriophyllae* (p. 456)

10. Leaves pinnate.
11. Calyx glabrous externally, only the orifice and inner face of teeth pilosulous.
12. Teeth of calyx, especially the dorsal one, hooked at apex.
141. *D. scandens* (p. 525)

12. Teeth of calyx straight or (in fruit) sigmoidally curved but not hooked.
13. Calyx-teeth all, or at least the dorsal one, longer than tube. xxi. *Versicolores* (p. 459)

13. Calyx-teeth all shorter than tube.
14. Ventral pair of calyx-teeth united behind banner into a shallowly notched lip; small, yellow-flowered shrubs of Sierra Madre Oriental with leaves less than 2 cm long and 3–6 pairs of small leaflets.
117d. *D. capitata* var. *pseudo-hospes* (p. 447)

14. Ventral pair of calyx-teeth separated by a sinus as deep or deeper than the lateral ones; if yellow-flowered the leaflets more numerous and range otherwise.

15. Interfloral bracts both persistent and densely silky-pilose internally. Tall virgate herbs of centr. Mexico with numerous short, conelike spikes of small, greenish-white or ochroleucous flowers arranged in a terminal, almost leafless panicle; *leaflets* 7–13 pairs, 7–15 mm long, short-acuminate.

xiii. *Mucronatae* (p. 395)

15. Interfloral bracts glabrous within, or deciduous, or both; *epistemonous petals* mostly anthocyanic, if white or yellow the leaflets much smaller or fewer.

16. Petals all opening yellow, fading brownish-purple or blackish.

17. Interfloral bracts persistent.

xxi. *Versicolores* (p. 459)

17. Interfloral bracts promptly deciduous.

138. *D. tolteca* (p. 512)

16. Petals, except sometimes the banner, not yellow, the epistemonous ones usually anthocyanic, sometimes all white.

18. Leaflets (2–4 pairs) pilose-tomentose; *calyx-tube* firm, not hyaline between ribs; *keel-blades* 2–3 mm long; *spikes* dense, arranged in a narrow, thyrsiform panicle.

101. *D. tomentosa* (p. 401)

18. Leaflets glabrous or thinly pilosulous, if pubescent the intercostal panels of calyx-tube hyaline; *keel-blades* mostly longer, if as small the leaflets glabrous or more numerous; *inflorescence* otherwise.

19. Bracts between flowers persistent, broadly hyaline-margined, each clasping base of a calyx or wholly concealing it; *leaflets* 2–5 (6) pairs; *epistemonous petals* dull violet or lurid purple, commonly perched on a column longer than the calyx-teeth, in any case much shorter (detached) than banner.

v. *Parosela* (p. 330)

19. Bracts deciduous, or if persistent narrowly lance-acuminate (therefore not clasping calyx); *epistemonous petals* bright pink or purple, perched below level of tips of calyx-teeth, the detached banner at least a little longer than banner.

20. Glands in each intercostal panel of calyx-tube arranged in one vertical rank; Chihuahua, n. Zacatecas, and Nuevo León n.-ward.
i. *Lasiostomae* (p. 302)

20. Glands in each panel of calyx-tube numerous, biseriate or scattered; range s. of the last.
21. Bracts deciduous before anthesis; Nueva Galicia (Jalisco, Nayarit).
iii. *Pectinatae* (p. 310)

21. Bracts persistent; e. San Luis Potosí.
ii. *Rzedowskianae* (p. 309)

11. Calyx pubescent externally, usually from base upward, always beyond middle of tube.
22. Epistemonous petals opening (and remaining) blue, purple, pink, violet, rarely pale lilac (fading whitish) or white, never yellow.
23. Slender monocarpic plants up to 4 (5) dm tall, usually represented in herbaria by complete plants showing the obviously annual root.
24. Leaflets 7–17 pairs:
cf. sect. *Psoropogon* ser. *Citriodorae* (p. 554)

24. Leaflets 1–6 pairs.
25. Leaflets exactly 3 or 5, the 3 distal ones forming a palmate trefoil, all linear-filiform, resembling the petiole and rachis, glabrous or minutely puberulent. xxvii. *Filiformes* (p. 534)

25. Leaflets 2–6 pairs, linear- to ovate-elliptic, the terminal one stalked, all broader than rachis, pilose with at least a few long spiral hairs.
26. Calyx-teeth subulate, longer than wide.
xxviii. *Reclinatae* (p. 536)

26. Calyx-teeth deltate, at least the ventral pair wider than long; annual forms of:
71. *D. obovatifolia* (p. 331)

23. Perennial herbs and shrubs, represented in herbaria by branches severed well above the root or, if less than 6 dm tall then commonly showing part of a perennial rootstock.
27. Leaves paripinnate, the odd leaflet represented by a minute appendage terminal to rachis. Leaflets 12–23 pairs, none over 6 mm long, diminishing upward along the rachis, densely pilosulous; Sa. Madre Occidental. 68. *D. similis* (p. 324)

27. Leaves imparipinnate.
28. First pair of 7–14 pairs of distant, suborbicular-cordate, fleshy leaflets larger than any succeed-

ing ones, situated close to leaf-pulvinus and suggesting a pair of stipules. Leaflets glabrous, 1–3 mm long; stems tuberculate; Sa. Madre Occidental and w. Jalisco.

xviii. *Pulchellae* (p. 448)

28. First pair of leaflets not longer (usually shorter) than all succeeding ones, and aspect of leaves otherwise.
    29. Leaflets of larger primary cauline leaves (caveat: these may be drought-deciduous and absent from specimens in advanced flower) 11–many pairs.
        30. Interfloral bracts densely pubescent internally; *spikes* very dense, conelike; uncommon spp. of Balsas Depression (Morelos, Puebla, Guerrero).
            31. Leaves softly densely pilosulous; *shrubs* to 2.5 m; *petals* concolorous, all pale brownish-rose.

xiv. *Cinnamomeae* (p. 398)

            31. Leaves glabrous; *herbs*, scarcely suffrutescent, to 1 m tall; *petals* bicolored, the banner whitish (rubescent), the rest blue or purple.

xix. *Laguroideae* (p. 450)

        30. Interfloral bracts glabrous internally; *spikes* not more than moderately dense.
            32. Glands in intercostal panels of calyx-tube numerous, scattered or irregularly 2-seriate; *calyx-teeth* (except sometimes the dorsal one) shorter than tube.

iii. *Pectinatae* (p. 310)

            32. Glands in panels of calyx-tube vertically 1-seriate, sometimes obsolete; *calyx-teeth* longer than tube.

xxi. *Versicolores* (p. 459)

    29. Leaflets of largest leaves 10 pairs or less.
        33. Largest cauline leaves with more than 6 but less than 11 pairs of leaflets.
            34. Interfloral bracts ± silky-pubescent within; *teeth* of calyx shorter than tube.
                35. Stems densely prominently tuberculate; *plants* of Meseta Central and Sa. Madre Oriental in Mexico, s. to Oaxaca.

xvi. *Tuberculatae* (p. 412)

                35. Stems smooth; *plants* of Balsas Depression.

xix. *Laguroideae* (p. 450)

34. Interfloral bracts glabrous within.
    36. Calyx teeth longer than tube, plumose.
        37. Leaflets 1–1.4 cm long, broadly ovate, apiculate, plane; Sa. Madre Occidental (Durango-Sinaloa).
            xxiii. *Seemannianae* (p. 502)
        37. Leaflets shorter and of narrower outline, mostly navicular; widespread.
            xxi. *Versicolores* (p. 459)
    36. Calyx-teeth shorter than tube or the dorsal one alone as long, not plumose though often densely pilosulous.
        38. Spikes capitate, very dense and conelike; *bracts* persistent at least through anthesis; *banner* ± as long as detached keel; rare spp. of Sa. Madre Occidental and Nueva Galicia.
            39. Stems densely verruculose; *stipules* 3–6 mm long; *epistemonous petals* inserted well below middle of androecium, the claws of keel over 2.5 mm long; Durango and Nayarit.
                xii. *Cyaneae* (p. 392)
            39. Stems smooth; *stipules* 1.5–2.5 mm long; *epistemonous petals* near middle of androecium, the claws of keel 1–1.7 mm long; Jalisco.
                121. *D. mexiae* (p. 455)
        38. Spikes loose or moderately dense, never conelike though sometimes short; *bracts* deciduous before anthesis; both sympatric and allopatric with last.
            xxi. *Versicolores* (p. 459)
33. Largest cauline leaves with 2–6 pairs of leaflets.

40. Peduncles 1–5 dm long, the first and longest terminating each herbaceous stem as long and often longer than the leafy axis that bears it. Spikes very dense, usually massive, mostly 13–21 mm diam; *calyx-teeth* usually as long or longer than tube.

xxix. *Sericeae* (p. 541)

40. Peduncles shorter, usually much shorter than the leafy stem below it. Spikes various, but if very dense usually narrower.

41. Teeth of calyx longer than tube, the dorsal tooth 1.5–2 times as long; *leaves* glabrous.

xxi. *Versicolores* (p. 459)

41. Teeth of calyx shorter than tube or the dorsal tooth as long, but, if as long or slightly longer, the leaves pubescent.

42. Calyx-teeth deltate, the ventral pair wider than long; *epistemonous petals* perched above middle of androecium; forms of.

71. *D. obovatifolia* (p. 331)

42. Calyx-teeth triangular-subulate, even if broadly so the epistemonous petals always perched well below middle of androecium.

43. Primary cauline leaves 1.5–4 cm long; *leaflets* relatively large, some over 6 mm long, pubescent both above and below.

44. Stems densely prominently verruculose.

xvi. *Tuberculatae* (p. 412)

44. Stems smooth or almost so.

xv. *Psoraleoides* (p. 400)

43. Primary cauline leaves less than 1.6 cm long, the leaflets mostly less than 6 mm long (if slightly longer then glabrous at least above).

45. Interfloral bracts glabrous internally.
xxi. *Versicolores* (p. 459)
45. Interfloral bracts pubescent internally: return to choice 35/35.

22. Petals all opening yellow or greenish-yellow, at least the epistemonous ones early fading brown, orange, dull brownish-purple, or black.
46. Slender annual herbs, rarely biennant; *leaflets* 2–5 pairs, glabrous; *calyx-teeth* longer than tube, plumose; *flower* small, the keel-blades 2–3 (4) mm long.
xxvii. *Brachystachyae* (p. 531)
46. Shrubs and herbs, the latter always perennial and commonly suffruticose when adult, if simply herbaceous the foliage usually pubescent, or flower larger (or both).
47. Interfloral bracts deciduous by anthesis of each flower.
48. Leaves 3–11 cm long, with 2–5 pairs of acute or short-acuminate leaflets 1–2.5 cm long; *spikes* few, laxly many-flowered, the axis 2.5–12 cm cm long; s. Mexico.
xxiv. *Leptostachyae* (p. 503)
48. Leaves variable in length and number of leaflets, but if the leaflets as few then smaller, if as large then the spikes many and short, the axis of the longest not over 3 cm long, most of them subcapitate; widespread.
49. Calyx sessile; *spikes* many, forming a corymbose or (by shortening of secondary and tertiary branchlets) thyrsiform panicle, mostly short and subcapitate, the axis of all but a few central ones less than 2 cm long.
xxv. *Thyrsiflorae* (p. 506)
49. Calyx pedicelled, the pedicel sometimes very short; *spikes* few, commonly 3–5 to each primary cauline axis, not capitate, the axis 1–5 cm long.
131. *D. melantha* (p. 481)
47. Interfloral bracts persistent, falling only with fruiting calyx.
50. Leaves 1.5–7 cm long, with 5–10 (15) pairs of leaflets 3–14 mm long, some leaflets almost always over 6 mm long; *shrubs* well over 6 dm tall or if shorter herbaceous; *spikes* usually many-flowered and calyx-teeth usually (not consistently) longer than tube and plumose; widespread over Mexico and Central America.
130. *D. lutea* (p. 475)

50. Leaves up to 1.6 cm long, with 2–6 pairs of small fleshy leaflets 1.5–5.5 mm long; *small desert shrubs* mostly less then 5 dm tall; *spikes* mostly 2–20-flowered and *calyx-teeth* always shorter than tube, often silky-pubescent externally but not plumose; arid n. Mexico, on Meseta Central and intermontane Sa. Madre Oriental.
117. *D. capitata* (p. 444)

B. Key to the Series of Sect. *Parosela* present in South America and Islas Galápagos

(Note: because all native *Dalea* s. of Panama is included in sect. *Parosela* and there are in addition only 3 naturalized annuals, these are introduced in the following key, which should serve for the entire continent.)

1. Plants of Islas Galápagos. Small xerophytic shrubs with mostly minute leaflets and calyx-teeth longer than tube. 140. *D. tenuicaulis* (p. 524)
1. Plants of continental South America.
   2. Inflorescence racemose, each calyx elevated on a pedicel 0.7–1.5 mm long. Shrubs of Ecuador, with large blue and white flowers (keel-blades 7.5–9 mm long) and externally glabrous calyces, the teeth much shorter than the tube.
viii. *Jamesonianae* (p. 342)
   2. Inflorescence spicate, each flower sessile or almost so (pedicels 0–0.1 mm mm long).
      3. Dorsal tooth of calyx shorter than the tube as measured from its base to a dorsal sinus.
         4. Flowers relatively large, the keel-blades 5 mm long or more.
            5. Calyx-tube 20-ribbed; *petals* all yellow; Peruvian shrubs with very small leaves and leaflets, the latter only 2–3 mm long.
xi. *Galbinae* (p. 391)
            5. Calyx-tube 10-ribbed; *petals* usually partly blue or purple, if pale yellow the leaflets much larger.
ix. *Coeruleae* (p. 344)
         4. Flowers smaller, the keel-blades less than 5 mm long.
            6. Leaflets of larger primary leaves 10 pairs or more; *plants* glabrous to the spikes; coarse weedy annual herbs, adventive in S. America; *interfloral bracts* deciduous by anthesis.
               7. Adaxial sinus of calyx-tube deeply recessed behind banner; *bracts* lanceolate, shallowly concave, not clasping the flower-buds; *banner* much longer than detached keel, the blades of which are narrowly imbricate, not valvate; *prow* of pod filiform; Andean Plateau, s.-e. Chile through Bolivia into n.-w. Argentina. 27. *D. leporina* (p. 210)
               7. Adaxial sinus not or scarcely deeper than the rest; *bracts* broadly ovate, contracted into a short tail, conduplicate, clasping flower-buds and younger calyces; *banner* shorter than detached keel, the blades of which are valvately adherent by outer edges; *prow* of pod dilated, corneous; Venezuela and Colombia.
147b. *D. foliolosa* var. *citrina* (p. 559)

6. Leaflets 3–8 (9) pairs; perennial and few (rare annual herbs and shrubs, if annual either the interfloral bracts persistent or the stems and foliage at least thinly pubescent.
   8. Annual herbs with stiff, angular stems, glabrous up to the dense conelike spikes of small calyces alternating with imbricated, persistent bracts; *orifice of calyx* hardly oblique except for the abruptly and deeply recessed adaxial sinus; keel-petals (bright blue) free from each other, when detached very much shorter than the white banner; weedy plants of tropical arid lowlands, adventive in Venezuela and Ecuador. 18. *D. cliffortiana* (p. 191)
   8. Shrubs, perennial herbs, and 2 annual herbs, but these of Bolivian or Peruvian Andes and their stems at least thinly hairy; *spikes* only moderately dense; *orifice of calyx* often obliquely truncate but the adaxial sinus not very asymmetrically recessed; *keel-petals* adherent valvately by their outer margins, usually longer than the banner.
      9. Filiform annual herbs of Pacific slope in s. Peru; *petals* scarcely exserted, the detached keel shorter than banner, perched above middle of androecium; *androecium* ± 7-merous, but functionally 5-merous. x. *Moquehuanae* (p. 390)
      9. Shrubs and herbs, these perennial except Bolivian *D. tapacariensis* which has small but well-exserted petals; *keel* perched below middle of androecium, when detached as long, commonly longer than banner; *androecium* 10-merous.
         10. Petals from the first strongly bicolored, the banner opening whitish (rubescent), the wings or keel (usually both) blue or purple; *herbs and some erect shrubs*, each main cauline axis bearing 1–5 (rarely more) spikes, at least the first of these (especially if more than 5) cylindroid, several times longer than its diameter. ix. *Coeruleae* (p. 344)
         10. Petals all opening greenish-yellow or ochroleucous, fading dull purplish or brownish, never vivid purple nor blue; *erect shrubs* of n. Peru and Ecuador with richly branching stems passing into a many-headed panicle of small spikes, all but the first of each primary division subcapitate and even the first short, less than twice as long as its diameter.
            139g. *D. carthagenensis* var. *brevis* (p. 521)

Dorsal tooth of calyx longer than the tube measured to a dorsal sunus.

11. Keel-blades vivid (rarely pale) blue or purple from the first, contrasting at early anthesis with a whitish, later rubescent banner, usually large (over 5 mm long) but if less than 5 mm long then the spikes cylindric and 3–12 cm long. ix. *Coeruleae* (p. 344)
11. Keel-blades like other petals opening greenishly-yellow and early fading dull purple or brownish, small, ± 3–4.5 mm long; *spikes* (numerous, paniculate) all short, mostly capitate, the first and longest of each division of the panicle rarely up to 2.5 cm long.
    139. *D. carthagenensis* (p. 513)

IVC (i). Series Lasiostomae (Rydberg) Barneby

Perennial herbs and slender shrubs, glabrous to the inflorescence or thinly pilosulous, the young stems ± tuberculate; *leaflets* of primary leaves 2–15 pairs, small and carnosulous or submembranous and up to 1 cm long; *spikes* or *racemes* loose, the sessile or pedicellate calyces not concealing axis of inflorescence; *calyx* externally glabrous or rarely thin-pilosulous, the intercostal panels of tube charged with uniseriate glands, the orifice subsymmetrical, the deltate to broadly ovate or triangular teeth shorter than tube, internally pilosulous and ciliolate; *petals* in 2 spp. bicolored, the banner opening whitish (rubescent), the keel and wings purple, in 1 sp. concolorous, ochroleucous (fading brownish), at least the banner gland-tipped, the proportionately ample banner little shorter (or a trifle longer) than detached keel, the epistemonous petals perched below (in *D. hospes* near) middle of androecium, the keel-blades 3–6.5 mm long. — Spp. 3, largely calciphile, widely ranging over Texas (marginally to states adjacent n. and w.) and s., through and around the Chihuahuan Desert and Sierra Madre Oriental to the valley of México, Puebla, and centr. Oaxaca.

Dalea subgen. **Parosela** sect. **Parosela** ser. **Lasiostomae** (Rydb.) Barneby, comb. nov., based on *Parosela* subgen. *Trichopodium* IV. *Lasiostomae* Rydb., N. Amer. Fl. **24**: 56. 1919. — Sp. lectotypica: *P. hegewischiana* (Steud.) Rydb. = (syn. tax.) *P. lasiostoma* Rose = **Dalea hegewischiana** Steud.

Parosela subgen. *Euparosela* XIX. *Frutescentes* Rydb., N. Amer. Fl. **24**: 84. 1920. — Sp. lectotypica: *P. frutescens* (Gray) Rose = **Dalea frutescens** Gray.

A series disproportionately heterogeneous for its small size, and perhaps not phylogenetically sound. In this respect it is at least an improvement on the original *Lasiostomae* Rydb. which, referred to *Parosela* subgen. *Trichopodium* because of the pedicelled calyces superficially like those of genus *Marina*, included beside two pubescence phases of *D. hegewischiana* the only remotely related *Psorothamnus thompsonae* and the peculiar *Dalea* (sect. *Viridalea*) *viridiflora*. To the reduced essence of this group I here add Rydberg's *Frutescentes*, rightly referred by him, even though one of its two species has pedicellate calyces, to *Parosela* subgen. *Euparosela*. This pair differs collectively from *D. hegewischiana* in their decidedly fruticose, not diffuse herbaceous habit of growth, but the foliage, the short-toothed calyces silvery-ciliolate around the mouth, and the form of the petals is much alike in all. The most marked aberration is found in the flower of *D. hospes*, the petals of which are, unlike the rest, ochroleucous or pale yellow, fading brownish, and further peculiar for the high-perching, short-clawed wings and keel. This species suggests (as mentioned below in greater detail) an unexpected thread of relationship leading directly between ser. *Lasiostomae* and, by way of *D. melantha* var. *berlandieri*, the otherwise only distantly related ser. *Versicolores*. As defined herein the *Lasiostomae* are held together by a common calyx, shared with sect. *Viridalea* immediately preceding. A rather similar short-toothed calyx reappears in the next two series, but with numerous scattered glands in each panel of the tube. The monotypic ser. *Rzedowskianae* immediately following differs further in its persistent floral bracts; the *Pectinatae* with short-toothed calyces differ further in habit and ecology. Two species of ser. *Lasiostomae, D. frutescens* and *D. hospes*, are notable for harboring the rafflesiaceous stem-parasite *Pilostyles*.

Key to the Species of Ser. *Lasiostomae*

1. Petals all opening pale greenish-yellow, the epistemonous ones perched high on androecium, at least the keel inserted above the level of tips of calyx-teeth; *leaflets* 2–5 pairs, some commonly over 5 mm long; *erect shrubs* up to 1.5–3 m tall; n. Sierra Madre Oriental and desert ranges of Coahuila. 56. *D. hospes*.

1. Petals bicolored, the epistemonous ones rose or purple, perched below the level of tips of calyx-teeth; *leaflets* often more numerous and all less than 5 mm long; small shrubs and diffuse herbs, the stems seldom 1 m long, usually much less. Calyx either pedicellate or sessile.
   2. Calyx sessile, 3.8–4.2 mm long, the panels of the tube charged with 3–7 glands; *flower* relatively large, the keel-blades 5–6.5 mm long; *small shrubs* with erect and incurved-ascending branches, of s.-w. United States and n.-e. Mexico (s. to Nuevo León, n. Zacatecas, and centr. Chihuahua).
   57. *D. frutescens.*
   2. Calyx pedicelled, including teeth only 2.6–3.4 mm long, the panels of the tube charged with 1–2, rarely 3 glands (at least one of them a prominent blister); *flower* small, the keel-blades ± 3–4 mm long; *diffuse herbs* of s. centr. Mexico (s. Hidalgo, Querétaro, Distrito Federal, s. through Puebla to centr. Oaxaca). 58. *D. hegewischiana.*

56. Dalea hospes (Rose) Bullock
(Plate LXIV)

Shrubs with slender crooked trunk irregularly branching distally, 1.5–2.4 (3) m tall, glabrous to the inflorescence, the old bark gray, the younger woody branches striped lengthwise, the young twigs slender pliant, livid, smooth or distantly tuberculate, the foliage green, the leaflets smooth or finely punctate above, either punctate or tuberculate beneath; *leaf-spurs* 0.3–0.8 mm long; *stipules* triangular-subulate, thin-textured, 0.5–1 mm long; *intrapetiolular glands* 0; *post-petiolular glands* conic, prominent, orange; *leaves* short-petioled, the main cauline ones (0.7) 1–2 cm long, with narrowly margined rachis and 2–4 (5) pairs of obovate-cuneate, obovate, or broadly oblanceolate, obtuse or emarginate, flat leaflets 3–10 mm long, the terminal trefoil usually larger than the rest, the rameal leaves smaller; *peduncles* leaf-opposed and terminal to branchlets, 0.5–3 (5) cm long; *racemes* loosely (5) 10–30 (35)-flowered, the glabrous axis finally (1) 1.5–5 cm long; *bracts* clasping young buds but early deciduous, broadly elliptic-ovate or ovate-acuminate, 1.8–3 mm long, submembranous, pallid or livid, dorsally glandular, minutely ciliolate; *pedicels* ascending 0.4–1.5 mm long; *calyx* 3.8–4.8 mm long, either glabrous or sparsely pilosulous externally, the orifice and inner face of teeth densely ciliolate, the tube pleated at base, 2.6–3.2 mm long, the ribs prominulous, the submembranous intervals charged with 1 (sometimes irregular) row of 3–5 honey- or orange- to livid-colored glands, the teeth unequal, the dorsal one broadly subulate, 0.9–1.8 mm long (not over ⅔ as long as tube), the rest broadly low-deltate and short-acuminate, often gland-spurred; *petals* pale greenish-yellow or ochroleucous, the banner (sometimes all) brownish-rubescent, all or only the banner gland-tipped, the epistemonous ones perched near middle of androecium (above mouth of calyx), 3.4–5.4 mm above hypanthium; *banner* 5.5–7 mm long, the claw 3–4.1 mm, the broadly ovate-deltate blade 2.9–3.6 mm long, 3.2–4.4 mm wide, recessed at base into a cornet; *wings* 4.8–5.2 mm long, the claw 0.7–1.2 mm, the blades oblong-oblanceolate ± 4.5 mm long, 2.4–2.7 mm wide; *keel* 6.7–8 mm long, the claws 2–2.2 mm, the broadly obovate blades 5.2–6 mm long, 3.1–3.8 mm wide; *androecium* 10-merous, 8–11 mm long, the longer filaments free for ± 2.4–2.8 mm, the anthers 0.6–0.8 mm long; *pod* 3–3.7 mm long, in profile triangular-obovate, the style-base latero-terminal, the prow slightly dilated (± 0.2 mm thick), the valves hyaline in lower half, thence papery, minutely gland-sprinkled, pilosulous; *seed* ochraceous, lustrous ± 2.3 mm long. — Collections: 22 (iii).

Brushy hillsides and rock-ledges in canyons, strongly calciphile, (850) 1020–2100, reportedly 2500 m (2825–7000, perhaps 8325 ft), locally plentiful on the e. slope

and higher interior valleys of Sierra Madre Oriental in Nuevo León and immediately adjoining centr. Tamaulipas, from Monterrey s. to lat. 24° N, and n.-ward from Monterrey on outlying calcareous mountains to near Lampazos, Nuevo León at ±27° N. and in the same latitude w. into centr. Coahuila (Sas. de la Gloria and de la Madera). —Flowering irregularly, May to November. —*Representative*: COAHUILA: *Mueller 3156* (UC). NUEVO LEÓN: *Mary Taylor Edwards 439* (ARIZ); *Chase 7766* (ARIZ, F, NY); *Mueller 2348* (F, GH, TEX); *Mosquin 6574, 6594* (NY); *Ripley & Barneby 13,590* (CAS, NY, US), *13,595* (CAS, MEXU, NY, US); *Meyer & Rogers 2875* (BR, F). TAMAULIPAS: *H. H. Bartlett 10,970* (F, MEXU, RENNER).

Dalea hospes (Rose) Bullock, Kew Bull. **1939**: 196. 1939, based on *Parosela hospes* (host, to the stem parasite *Pilostyles pringlei* Rose) Rose, Contrib. U. S. Nat. Herb. **12**: 272. 1909. — "Collected by C. G. Pringle in the Sierra Madre above Monterey, in 1888 (no. 1904, type) and 1903 (no. 11417); also by Dr. E. Palmer in the Caracol Mountains, Coahuila, in 1880 (no. 210)." — Holotypus (*Pringle 1904*), US! isotypi, BR, F, M (2 sheets), NY (2 sheets), UC! paratypi: *Pringle 11,417*, F, L, US! *Palmer 210*, NY, US!

An oddly but strongly characterized dalea, which might be described as a drawn-out version of *D. frutescens* with pedicellate flowers and pale yellow petals. Its kinship to *D. frutescens* is expressed by likeness in foliage, calyx, and other flower-parts, but the growing plants are superficially very different, *D. frutescens* being a low bushy shrub usually many stemmed, whereas *D. hospes* develops one or few long skinny trunks (rarely 1.5 cm diam) that branch 1–2 meters above ground into a narrow and irregular or sometimes more symmetrically doming panicle of branchlets. The range, habitat, and habit of growth of *D. hospes* are suggestively reminiscent of *D. melantha* var. *berlandieri* which has, perhaps not coincidentally, a similarly racemose inflorescence and petals of a pale ivory or lemon yellow. In practice the latter is separated directly by its externally long-pilose, long-toothed calyx, but it seems not impossible that *D. hospes* may have arisen in the first place as the progeny of miscegenation between *D. frutescens* and *D. melantha*.

Populations of *D. hospes* differ in pubescence of the calyx, sometimes glabrous and glossy externally as in *D. frutescens*, sometimes thinly pilosulous, but always densely ciliolate around and within the short-toothed orifice. Mosquin noted bees (near Monterrey) and various Hymenoptera (Galeana) as insect-visitors to the flowers.

57. DALEA FRUTESCENS Gray
(Plate LXIV)

Slender, intricately branching shrubs up to 3–8 (12) dm tall, glabrous up to the nearly always thinly or minutely pilosulous axis of the flower-spikes, the branches either erect and ascending or decumbent at base and then commonly layering and thence incurved-ascending, thereby forming small thickets, the older stems pale brown furrowed, the new twigs greenish or livid, at least distally gland-tuberculate, the foliage green, the leaflets thick-textured, ± bicolored, brighter green above, paler and punctate beneath; *leaf-spurs* 0.2–1 mm long; *stipules* subulate to narrowly triangular-acuminate, subglandular becoming dry and papery, 0.3–1.3 mm long; *intrapetiolular glands* 0; *post-petiolular glands* conic, prominent; *leaves* shortly petioled, the main cauline ones 1–2 cm long, with narrowly margined, ventrally grooved, punctate rachis and 4–9 (10) pairs of obovate to broadly oblanceolate and obtuse to emarginate, or obcordate, mostly navicular but not tightly folded leaflets 1.5–3.5 (5) mm long, the rameal and spur-leaves shorter, with fewer smaller leaflets, the terminal leaflet of all leaves sessile; *peduncles* leaf-opposed and terminal to all ultimate branch-

lets, 0.2–4.5 (5) cm long; *spikes* (3) 6–25 (30)-flowered, most commonly subcapitate to moderately dense and oblong, rarely loose (calyces finally up to 2–4.5 mm apart), the pilosulous (rarely glabrous) axis becoming 2–25 (35) mm long; *bracts* deciduous from peglike spurs, broadly ovate and short-acuminate to merely gland-mucronulate, less often ovate and long-acuminate, navicular and enfolding the buds, 2.2–3.4 (4.5) mm long, glabrous or nearly so and gland-pustulate dorsally, commonly ciliolate near base, thinly pubescent within; *calyx* 3.8–4.2 mm long, the shallowly pleated, lustrous, glabrous tube 2.6–3.2 (3.5) mm long, the reddish or concolorous ribs becoming prominent, the rather firm intervals charged with ± 3–5 (7) elliptic, red or orange blister-glands, the orifice silky-ciliolate, the teeth deltate-acuminate to broadly triangular or low-deltate, often gland-spurred, the dorsal one 0.5–1.2 mm long, the ventral pair broader and shorter; *petals* bicolored (exceptionally all white), the banner whitish with green-yellow eye but early rubescent, the vivid pink-purple epistemonous ones perched 1.5–3.5 mm above hypanthium, all eglandular or the banner and keel rarely gland-tipped and the banner charged with a small gland-crescent; *banner* 5.1–6.2 mm long, the claw 2.4–2.9 mm, the ovate-cordate, hooded blade recurved through 50–80°, deeply recessed at base into a cornet, 3.2–4.2 mm long, 3.4–4.6 mm wide; *wings* 5.5–6 mm long, the claw 1–1.6 mm, the ovate-oblong blade 4.3–5.2 mm long, 2.7–3 mm wide; *keel* 6.5–8 mm long, the claws 1.5–2.2 (2.4) mm, the ovate-elliptic blades (5) 5.3–6.5 mm long, 3.3–3.9 mm wide; *androecium* 6.8–8.2 mm long, the longest filaments free for 1.8–2.7 mm, the connective gland-tipped, the anthers 0.55–0.75 mm long; *pod* obliquely triangular in profile, 2.8-3.5 mm long, the style-base latero-terminal, the prow slender but prominent, the valves hyaline in lower ½, thence thinly herbaceous, minutely gland-sprinkled, glabrous or thinly pilosulous; *seed* brown, ochraceous, or olivaceous, smooth, 1.7–2.3 mm long; $n = 7$ (Spellenberg, 1973). — Collections: 107 (vii).

Rocky hillsides, washes, and stony clay flats, often associated with scrub-oaks, junipers, or mesquite, ascending in New Mexico to 1950 m (± 6500 ft) and in trans-Pecos Texas to 2240 m (7450 ft), strongly but not obligately calciphile, widespread over central Texas n.-ward from Balcones Escarpment through the hill country to Fort Worth and Dallas, and locally to the Arbuckle and Wichita mts. in s.-centr. and s.-w. Oklahoma, w. (very abundant) over Edwards Plateau and through trans-Pecos to the Guadalupe and White mts. in s.-e. New Mexico, s. (still frequent) through detached mountain ranges of Coahuila to extreme n. Zacatecas (mpo Mazapil) and the e. piedmont of Sierra Madre Oriental in Nuevo León (Monterrey s. to Montemorelos), from Coahuila w. into the angle of Chihuahua below the Big Bend of Río Bravo, and feebly w. across the Conchos valley (Julimes) to the e. foothills of Sierra Madre Occidental in centr. Chihuahua (near Cd. Chihuahua). — Flowering (May) July to November. — *Representative*: UNITED STATES. NEW MEXICO: *Earle & Earle 407* (NY, W); *Wooton 534* (NY). OKLAHOMA: *E. J. Palmer 44,042* (NY, UC); *Waterfall 6397* (NY, OKLA); *Hopkins et al. 808* (OKLA, WIS). TEXAS: *Tracy 8333* (NY, W); *Mainland & Barkley 14,519* (NY, OKLA, UC, WIS); *Ripley & Barneby 13,242* (CAS, MEXU, MICH, NY, US), *13,531* (CAS, MICH, NY, US); *Warnock 21,825* (NY, UC); *Moore & Steyermark 3345* (NY, UC). MEXICO. CHIHUAHUA: *Pringle 658* (BR, F, M, NY, UC); *Stewart 2420, 2517* (GH). COAHUILA: *Palmer 205, 206, both in 1880* (F, NY); *Johnston 8268* (GH, TEX), *8948* (GH); *Marsh 1350* (F, GH, OKLA); *Ripley & Barneby 14,220* (CAS, NY, US); *Ripley 14,957* (CAS, NY). NUEVO LEÓN: *Palmer 212 in 1880* (NY); *E. W. Nelson 6093* (F, NY, US). ZACATECAS: *Stanford, Wetherford & Northcraft 564* (ARIZ, NY).

Dalea frutescens (becoming shrubby) Gray, Boston Jour. Nat. Hist. **6**[2] (Pl. Lindh. **2**): 175. 1850. — "376...on the Guadeloupe, Sabinas, and Pierdenales. July, August. (Western Texas, *Mr. Charles Wright*. Monterey, N. Mexico, *Dr. Edwards in Herb. Torr.*" — Holotypus, *Lindheimer 376*, collected in 1846, GH! isotypi, NY, US, W! paratypi, *Wright 119*, NY, OXF, US, and *1353*, NY! (from Live Oak Creek and Pass of the Limpia, respectively), *Edwards & Eaton in 1846*, NY (herb. Torr.)! — *Parosela frutescens* (Gray) Rose, Contrib. U. S. Nat. Herb. **8**: 303. 1905.

Parosela laxa (loose, of the flower-spike) Rydb., N. Amer. Fl. **24**: 85. 1920. — "Type collected in the vicinity of Devils River [Val Verde Co.], Texas, October 16, 1913, *Rose & Fitch 17957...*" — Holotypus, NY, isotypus, US! — *Parosela frutescens* var. *laxa* (Rydb.) B. L. Turner, Field & Lab. **24**: 16. 1956.

A small, neatly attractive shrub, seldom more than knee-high, with crooked stems that root when decumbent and so form little thickets of rich green foliage, this disappearing in summer or early fall under a veil of rose-purple flowers. Except where it approaches, in Nuevo León and adjoining southeastern Coahuila, the related but taller and yellow-flowered *D. hospes*, it is the only dalea in its range characterized by a short-toothed calyx glossily glabrous externally but fringed around and within the orifice with short silvery hairs. Variation in *D. frutescens* is noticeable only in a few features and amounts to little in the context of sect. *Parosela*. In Texas the main cauline leaves have four to nine pairs of leaflets, and most of them five or more; south of Rio Grande there are seldom more than five pairs. Prevailingly the flower-spike is moderately compact, but varies according to number of flowers from capitate to oblong, the spikes terminal to lateral branchlets being generally shorter than that terminal to a primary axis. A loose spike, with flowers or pods spaced along the axis at intervals of 2–4 mm, is of some frequency in south-central Texas, especially on the lower Pecos and Devils rivers. It was found first by Charles Wright (no. *120*), as mentioned by Gray in *Plantae Wrightianae*, and is the one differential character ascribed to *Parosela laxa*. However, plants with subcapitate and loosely spicate inflorescences have been seen side by side in Kerr County, Texas (*Barneby 13,538*) and much of the material from outlying stations in the Arbuckle Mountains in Oklahoma are of the *laxa* type (cf. *A. & R. Nelson & Goodman 5385*, in part, UC). Turner (1959, p. 150, map 92) maintained for this form a *D. frutescens* var. *laxa*, but it seems hardly to deserve formal recognition. Ordinarily the spike-axis is pilosulous, but the hairs are sometimes few and short, occasionally absent. In east-central Texas the peduncles are mostly short (up to 1.5 cm) whereas in Mexico and west of the Pecos the more vigorous, central spikes are elevated on peduncles up to 1.5–4.5 cm long. In Mexico the bracts tend to be longer than in Texas, their tails longer and more tapering. In short, there are signs of incipient racial differentiation within the species, but none emerge as stabilized or geographically segregated.

58. Dalea hegewischiana Steudel
(Plate LXV)

Perennial herbs, weakly suffrutescent at base in age, the slender, stramineous or purplish, verruculose stems humifusely radiating from the root-crown or short caudex, or (in protection of brush) rarely assurgent, (1.5) 2.5–8 (14) dm long, freely branching from base or at least from near the middle, the lateral branches often forming fan-shaped sprays, the earliest spikes leaf-opposed but most of them terminal to leafy branchlets, the whole commonly glabrous up to the ciliolate orifice of calyx but some young branchlets, or young leaves, or stipules and bracts, or raceme-axes (or some of these) often thinly pilosulous with widely spreading hairs less than 0.5 mm long, the foliage bicolored, the leaflets green above, pallid or glaucescent and punctate beneath, some axillary innovations appearing low on the stems following or during late anthesis

sometimes densely gray-pilosulous; *leaf-spurs* up to 0.5 mm long; *stipules* linear-subulate, pallid, brownish, or livid, 1–2.5 mm long, becoming dry and fragile; *intra-petiolular glands* 1, rarely 2, subulate or conic; *post-petiolular glands* prominent, conic, orange; *leaves* subsessile or short-petioled, the main cauline ones 1–3 (4.5) cm long, with narrowly margined, remotely punctate rachis and 6–15, rarely only 4–5 pairs of obovate, oblong-obovate, obovate-cuneate, or oblong-elliptic, emarginate or retuse, flat or loosely folded leaflets 1.5–5 mm long, the leaves of distal branchlets often shorter, with fewer (sometimes as few as 4) pairs of smaller leaflets; *peduncles* 0.5–3.5 (6) cm long; *racemes* mostly (10) 15–50-flowered, rather loose (when pressed the flowers falling into 2–3 ranks and not concealing the glabrous to thinly pilosulous axis), without petals 6–7 mm diam, becoming 1–5.5 cm long; *bracts* deciduous, narrowly elliptic or oblanceolate, 1.5–3 mm long, pallid or castaneous in lower ⅓, livid-greenish and gland-verruculose distally, dorsally glabrous, ± pilosulous at least above middle within; *pedicels* 0.1–0.5 (0.7) mm long, charged at apex with a pair of glandular grains; *calyx* 2.6–3.4 mm long, the pleated, blunt-angled, lustrously hyaline, glabrous tube 2.2–2.7 mm long, 1.7–2.2 mm diam, the castaneous or hyaline ribs filiform, the intervals charged with 1 large (2 medium) and 1 superposed smaller, orange blister-glands, the green, broadly ovate or deltate teeth 0.3–0.8 mm long, gland-apiculate and often gland-spurred, pubescent within, the dorsal one slightly longer and narrower than the rest; *petals* bicolored, the banner opening whitish with green eye, rubescent, the epistemonous ones ruby- or claret-purple (when dry roseate), often paler along outer edges, perched 1.2–2.5 mm above hypanthium, the banner often and keel always gland-tipped, the banner sometimes glandular in the eye; *banner* 4.2–4.8 mm long, the claw (1.6) 1.9–2.5 mm, the ovate-cordate blade 2.3–3 mm long, 2.6–3.2 mm wide, recessed at base into a shallow cornet; *wings* 2.7–4 mm long, the claw 0.3–1 mm, the lance-ovate or -oblong blade 2.3–3.2 mm long, 1.2–1.6 mm wide; *keel* (detached, either a trifle shorter or longer than banner) 4.1–5.1 mm long, the claws 1.1–1.6 mm, the broadly ovate-elliptic blades 2.9–3.8 mm long, 1.6–2.3 mm wide; *androecium* 10-, rarely 8–9-merous, 4.5–5.8 mm long, the longer filaments free for 1.2–2 mm, the connective gland-tipped, the anthers 0.4–0.55 mm long; *pod* 1.8–2.2 mm long, triangular in profile, the very short style-base at corner, the prow slenderly carinate, the valves hyaline in lower ⅔, green and charged with a few small golden glands distally, either pilosulous along the prow or glabrous; 2n = 14 (Mosquin). — Collections: 20 (viii).

Gravelly and sandy bluffs and hilltops, usually in open, actively eroding sites, on chalky pumice, limestone, and volcanic bedrock, more rarely on brushy and grassy hillsides in thorn-forest, 1470–2400 m (4900–8000 ft), locally abundant in scattered stations in n.-centr. Oaxaca and s. Puebla, there crossing the low divide e. to the edge of Tehuacán desert, thence n.-w. over the plateau to the s. third of Hidalgo and immediately adjoining Querétaro and México; formerly on Cerro de Chapultepec in Cd. México, but not recently collected in Distrito Federal. — Flowering June to January, sometimes again in spring. — *Representative*: QUERÉTARO. Tequisquiapan: *Waterfall 13,929* (OKLA). HIDALGO. Tula: *Pringle 6937* (F, MEXU, MICH, NY, US). Tequixquiac, *Rose & Painter 6623* (NY, US). Pachuca: *Pringle 6936* (M, W, Z). MÉXICO (Edo): Teotihuacán: *Kenoyer A85* (F). MÉXICO (D. F.): *W. Schumann 186* (BM, M, W). PUEBLA. Tepeaca: *Amable distrib. Arsène 3579* (L, NY). Santiago Miahuatlán: *Ripley & Barneby 14,720* (NY). Tehuacán: *Holway in 1903* (GH, NY). Izúcar de Matamoros: *Ripley & Barneby 13,691* (CAS, NY, US). Petlalcingo: *Ripley & Barneby 13,677* (NY). OAXACA. Huajuapan de León: *Ripley & Barneby 13,644* (CAS, K, MEXU, MICH, NY, US). Nochixtlán: *Ripley & Barneby 14,587* (NY, US). Teposcolula: *Ripley & Barneby 13,666a* (CAS, MEXU, NY, US). Etla: *Ripley & Barneby 14,626, 14,658* (DAO, NY). Oaxaca de Juárez: *M. Carlson 1435* (F).

Dalea hegewischiana (Hegewisch, Hanoverian traveller in Mexico) Steud., Nom. Bot., ed 2, **1**: 480. 1840, a legitimate substitute for *D. laxiflora* (loose-flowered) Schlechtd., Linnaea **12**: 293. 1838. — "In terris Mexicanis (Hegewisch, hb. Lehm. et Bueck)." — No typus found, but the protologue agress in most details; cf. discussion infra. — Non *D. laxiflora* Pursh, 1814. — *Dalea rosea* (pink) D. Dietr., Syn. Pl. **4**: 1017. 1847, a later, superfluous substitute for the same. *Parosela hegewischiana* (Steud.) Rydb., N. Amer. Fl. **24**: 57. 1919.

Dalea schaffneri (Johann Wilhelm Schaffner, -1882) Hemsl., Diag. Pl. Nov. 7 1878. — "Mexico: prope Chapultepec, *Schaffner.*" — Holotypus, collected in June 1854, K! — *Parosela schaffneri* (Hemsl.) Rose, Contrib. U. S. Nat. Herb. **12**: 273. 1909.

Parosela lasiostoma (with hairy-mouthed calyx) Rose, Contrib. U. S. Nat. Herb. **8**: 305. 1905. — "Collected by G. C. Pringle on chalky bluffs near Tula, Hidalgo, 1902 (no. 8723, type) and at Cieneguilla, Oaxaca, November 1, 1894 (no. 5657)..." — Holotypus, US! isotypi, ARIZ, GH, L, M, MEXU, NY, W, Z!

Parosela campylostachya (with bent spikes, i. e. incurved to vertical) Rose, Contrib. U. S. Nat. Herb. **12**: 272. 1909. — "Collected by C. G. Pringle near Cieneguilla [= between Las Sedas and Tomelín, mun. Etla], November 1, 1894 (no. 5657)..." — Holotypus, US! isotypi, ENCB, MEXU!

A diffuse or humifuse perennial dalea with neat glaucescent foliage, easily recognized by the small, short-toothed, externally glabrous and lustrous calyces elevated on short pedicels and charged in the depressed intercostal membranes with 1–3 large, golden or orange blister-glands. The petals are bicolored, the banner opening whitish except for a small greenish eye-spot, finally rubescent, the epistemonous ones vivid ruby-red or wine-colored, sometimes appearing pallid in pressed specimens. The plants may be truly glabrous, except for silvery-pilosulous hairs inside the bracts and calyx-teeth, but the young branchlets are often puberulent and the young leaves may be pilosulous on one or both sides and ciliolate. In some specimens the summer growth that has borne flowers is hairless, but gives rise close to the ground to densely pubescent, gray-pilosulous innovations. Rydberg (1919, pp. 56, 57) maintained a pubescent *Parosela schaffneri* and a glabrous *P. hegewischiana*, but this is manifestly incorrect, for the actual type-collection of *D. schaffneri* is partly of the glabrous type, a mixture encountered on Chapultepec also by W. Schumann (cited supra). Over most of its range the leaflets of primary cauline leaves are seldom less than eight pairs, at least in some leaves, but on the high, cool and dry plateau in southern Hidalgo the species is represented by a depauperate form in which all leaves are reduced to about 4–6 pairs. I would think this variation worthy of some taxonomic notice except for the fact that Pringle collected at Tula some plants with no more than six but others (isotypi of *P. lasiostoma*) with 6–9 (10) pairs, the latter not significantly different from the common Puebla-Oaxaca form, although it was so interpreted by Rose. The original *D. lasiostoma*, which included elements of the plateau and the Oaxacan type, was proposed in ignorance of the earlier *D. schaffneri* and *D. laxiflora*, and was correctly reduced to synonymy by Rydberg. The description of *P. campylostachya*, calling for 21–45 leaflets, is simply erroneous.

Although no typus of *D. laxiflora* Schlechtd. has been seen, I am content to follow Rydberg in this matter. The protologue is detailed and describes the species very well except for a few points, probably of no importance. Schlechtendahl has the stems shrubby and erect, but the growth-habit of daleas in difficult to interpret from dried specimens and the discrepancy can be ignored. The spikes were said to reach a length of 3 inches, greatly in excess of anything collected since, and this does raise a difficulty. On the other hand, the description of the characteristic and unusual calyx, taken in conjunction with detailed measurements of the petals and the 8–10 pairs of small leaflets, suggest no other known species.

Rydberg (1919, p. 57) referred here with interrogation the still doubtful synonym *Trichopodium glandulosum* Presl. It is suspected, however, that this was based on a species of *Marina.*

IVC (ii). Series Rzedowskianae Barneby

Weakly suffrutescent, perhaps radicant, glabrous except for orifice of calyx, the young stems verruculose; *leaflets* of primary leaves 8–10 pairs, up to 3 mm long; *spikes* short but loose, few-flowered; *bracts* persistent; *calyx* externally glabrous, the intercostal panels of the ellipsoid tube charged with numerous scattered glands, the deltate-triangular teeth much shorter than tube; *petals* bicolored, the proportionately ample, whitish (rubescent) banner a little shorter than detached keel, its blade gland-tipped and -sprinkled, the low-perching epistemonous petals purple, the keel-blades ± 6.5 mm long. — Sp. 1, of middle elevations in w. foothills of Sierra Madre Oriental in s.-e. San Luis Potosí.

Dalea subgen. **Parosela** sect. **Parosela** ser. **Rzedowskianae** Barneby, ser. nov., inter ser. *Lasiostomas* et ser. *Pectinatas* intercalanda, illis habitu, his tubo calycino multiglanduloso similis, ab ambabus bracteis lanceolato-acuminatis firmis persistentibus adspectuque peculiari abstans. — Sp. unica: **D. rzedowskii** Barneby.

Strongly characterized at the specific level, *D. rzedowskii* does not fit easily into any preconceived serial category in the genus. I suppose it is related to *D. hegewischiana*, from which it differs in the much larger, multiglandular calyx subtended by persistent, firm and narrow bracts. The habit is little known, but the specimens examined suggest a low, adventitiously radicant shrublet akin to *D. frutescens*. The many glands in each panel of the calyx-tube recall ser. *Pectinatae* next in order, but no *Pectinatae*, and particularly none with similar calyx-teeth, are habitally comparable, and all shed the interfloral bracts before expansion of the flower.

59. Dalea rzedowskii Barneby

(Plate LXV)

Slender, weakly suffrutescent perennial herbs with arcuately procumbent, apparently tip-rooting, straminous or purplish, prominently gland-verruculose stems up to 6 m long (and probably longer), glabrous up to the internally pilosulous orifice of the calyx, the fine sparse foliage pallid-green or glaucescent, the leaflets smooth above, dotted beneath; *leaf-spurs* 0.3–0.6 mm long, charged at base with a prominent gland; *stipules* linear-acuminate, (0.8) 1.1–1.6 mm long, brownish-orange becoming livid, finally dry and fragile; *intrapetiolular glands* 0 or minute and impressed; *post-petiolular glands* very prominent, amber- or orange-colored; *leaves* subsessile, the main cauline ones (drought-deciduous) ± 12–20 mm long, with narrowly margined ventrally grooved, thinly verruculose rachis and ± 8–10 pairs of narrowly oblanceolate or (expanded) cuneate-oblanceolate, deeply emarginate, folded leaflets 2–3 mm long, the leaves of axillary spurs and subbasal innovations smaller but otherwise similar, the leaflets (4) 5–8 pairs and ± 1.2–2 mm long; *peduncles* terminal to the main axes and to some axillary short-shoots, 1–1.5 cm long; *spikes* shortly but loosely 6–15-flowered, the flowers spreading-ascending, the glabrous axis 4–7 mm long; *bracts* persistent, narrowly lance-acuminate, firm, livid-glaucescent, 3.5–4 mm long, grossly glandular dorsally and gland-tipped; *calyx* ± 5.1 mm long, broadly oblong-ellipsoid, a trifle tumid, externally glabrous and lustrous, the slender, scarcely prominulous ribs livid-tinted, the broad flat membranous yellowish intervals charged with 6–9 scattered or 2-seriate, hemispherical or ellipsoid, golden blister-glands (larger and smaller), the orifice ciliolate, the broadly low-deltate, externally glabrous, internally silky-pilosulous teeth gland-tipped and -spurred, the dorsal one ± 1 mm long, the rest slightly shorter and broader, the ventral sinus slightly shallower than the others; *petals* bicolored, the banner whitish with purple basal lobes, the epistemonous ones perched

low on the androecium (1.3–1.7 mm above hypanthium), all charged with a linear-elliptic subapical gland, the blade of banner gland-sprinkled; *banner* ± 8.2 mm long, the claw 3.6 mm, the broadly ovate-cordate, emarginate, hooded blade recessed at base into a shallow cornet, strongly recurved out of the calyx, 4.6–5 mm long, 3.6–4 mm wide; *wings* 8.5 mm long, the claw 2.3 mm, the oblong-elliptic blade 6.7 mm long, 2.1 mm wide; *keel* 10 mm long, the claws 3.7 mm, the elliptic blades 6.6 mm long, 3.2 mm wide; *androecium* 10-merous, 9.6 mm long, the longer filaments free for ± 3.3 mm, the connective gland-tipped, the bluish anthers 0.6 mm long; *ovary* submembranous, thinly pilosulous distally, the pod not seen. — Collections: 1 (typus).

In second-growth brush on loamy soil, 1400 m (4660 ft), known only from vicinity of Ciudad del Maíz, in s.-e. San Luis Potosí. — Flowering October and November, to be expected also in spring.

Dalea rzedowskii (Jerzy Rzedowski) Barneby, sp. nov., quoad calycem extus glabrum brevidentatum *D. hegewischianae* haud absimili forsan (sed haud proxime) affinis, sed bracteis persistentibus ac calyce magno sessili multiglanduloso procul recedens. A *D. gypsophila* Barneby fortasse propriori sed adspectu minus simili calyce brevidentato extus nitide glabro primu visu abhorret. — Herbae procumbentes hinc inde radicantes praeter calycis orem ciliolatum glaberrimae; *folia* 12–20 mm longa, foliolis 8–10 jugis anguste oblanceolatis 1.5–3 mm longis; *spicae* laxiusculae breves pauciflorae, floribus 6–15 bractea persistenti lanceolato-acuminata suffultis; *calyx* ± 5 mm longus, subtumidus, inter costas filiformes immersas grosse sparsim multiglandulosus, dentibus late deltatis tubo multoties brevioribus; *petala* bicoloria, vexillum albidum, epistemonea roseo-purpurea infra medium androecium insidentia carinae laminis ± 6.5 mm longis. — San Luis Potosí: terrenos margosos con vegetación de matorral secundario, 1400 m, 5 km al s. de Ciudad del Maíz, oct. 27, 1956, *J. Rzedowski 8290*. — Holotypus, ENCB.

IVC (iii). Series Pectinatae (Rydberg) Barneby

Perennial, mostly tall herbs, commonly suffrutescent in age but not characteristically shrubby, either glabrous to the spikes or pubescent throughout, the stems glandular but not conspicuously verruculose; *leaflets* numerous, over 12 pairs or (*D. nemaphyllidia* and *D. mcvaughii*, rare spp. of Nueva Galicia) only 7–10 pairs; *spikes* moderately dense to loose, never conelike; *interfloral bracts* deciduous; *calyx* sessile (in *D. nemaphyllidia* inconspicuously pedicellate), either glabrous or finely pilosulous externally, the tube subsymmetrical or strongly recessed behind banner, its membranous intercostal panels charged with small scattered (not vertically 1-seriate) glands, either longer or slightly shorter than the longest tooth; *epistemonous petals* low-perching, the blades blue, violet, purple, or pale lilac (fading whitish), the banner slightly shorter than the detached keel, the keel-blades 3.5–5, rarely to 7 mm long. — Spp. 10, chiefly of the oak-pine associations at middle elevations in Sierra Madre Occidental s.-ward from Durango, Nueva Galicia, the transverse Volcanic Belt w. from s.-w. México, 1 extending to San Luis Potosí, 1 extending to and another endemic in Oaxaca.

Dalea subgen. **Parosela** sect. **Parosela** ser. **Pectinatae** (Rydberg) Barneby, stat. nov., based on *Parosela* subgen. *Euparosela* XXV. *Pectinatae* Rydb., N. Amer. Fl. **24**: 92. 1920. — Sp. lectotypica: *P. pectinata* (Kunth) Rose = **Dalea pectinata** Kunth.

Parosela subgen. *Euparosela* XV. *Similes* Rydb., N. Amer. Fl. **24**: 79. 1920. — Sp. unica: *P. similis* (Hemsl.) Rose = **Dalea similis** Hemsl.

Parosela subgen. *Euparosela* XXXIV. *Crassifoliae* Rydb., N. Amer. Fl. **24**: 105. 1920. – Sp. lectotypica: *P. crassifolia* (Hemsl.) Rose = **Dalea crassifolia** Hemsl.

The series *Pectinatae*, which includes a number of species notable for an idiosyncratic facies (often due to one exceptional feature), is built up by accretion around the nucleus of Rydberg's more exclusive concept of the same name. This consisted of just two species *D. pectinata* and *D. abietifolia*, characterized by many small narrow leaflets, either glabrous or densely pilosulous. The calyx in both these species is membranous except for filiform ribs and its broad intercostal panels are sprinkled with more than one vertical rank of small glands. A similar calyx is encountered in *D. polystachya*, the substance of which formed part of Rydberg's group *Crassifoliae*, and the newly described *D. nobilis*; and this pair has also very numerous pairs of leaflets but these expanded, oval or oblong. In the *Pectinatae* mentioned to this point the calyx is finely pilosulous externally (sometimes thinly so in *D. polystachya*), and subsymmetrical at orifice, while its teeth vary from a little longer to a little shorter than the tube. In the pair, undoubted kindred, *D. escobilla* and *D. mcvaughii*, the calyx is only different in that the tube is hairless externally and the teeth are shorter and relatively wider; leaves of the first are almost those of *D. polystachya*, but in *D. mcvaughii* less elaborate, composed of only 7–9 pairs of ampler leaflets. The introduction to ser. *Pectinatae* of a species with so few leaflets opens the door to *D. nemaphyllidia*, which has with the calyx of *D. polystachya* (sometimes raised on a vestigial pedicel) leaflets narrow as in *D. abietifolia* but much longer, and only 7–10 pairs.

The epistemonous petals of the *Pectinatae* discussed so far are more or less brightly colored, but vary, sometimes in one species, from blue to purple, from purple to violet. A pair of rare daleas of Sierra Madre Occidental, *D. crassifolia* and *D. similis*, one with glabrous the other with densely pubescent foliage (like the original two *Pectinatae* Rydb.) differ collectively in having the (always pilose) calyx more oblique at mouth, long-toothed, and combined with pale lilac epistemonous petals. These might possibly be detached from *Pectinatae*, of which they have the many small leaflets, as an autonomous group, but it has seemed reasonable in this instance to follow Rydberg, who associated *D. crassifolia* with two phases of what is herein called *D. polystachya*, although he had not appreciated the latter's kinship to *D. pectinata*. The second member of the pale-flowered pair, *D. similis*, is unique in *Dalea* by virtue of its paripinnate leaves, their very numerous pairs of little boat-shaped leaflets diminishing upward along the rachis which terminates in a small appendage lacking the odd leaflet.

The *Pectinatae* are most numerous and diverse in Nueva Galicia and the southern half of Sierra Madre Occidental, broadly speaking in Durango, Nayarit, Jalisco, and Michoacán, only one, *D. polystachya*, extending southeast along Sierra Madre del Sur into Oaxaca. Thus *D. virgata* endemic to mountainous central Oaxaca is geographically isolated and is perhaps wrongly referred to the series. It differs from other *Pecinatae* in its somewhat ovoid rather than cup-shaped calyx-tube, internally silky bracts, and exceptionally large flowers. In facies, however, and in the leaflet-number, it agrees well enough.

As understood here, ser. *Pectinatae* is internally too diverse to permit a neat definition. The synodrome of characters that I have stressed may be summed up as: many leaflets; caducous interfloral bracts; a membranous calyx-tube with multiglandular intercostal panels; and a rather characteristic habit, the usually tall herbaceous (sometimes weakly suffrutescent) stems densely leafy but going out into a panicle of spikes subtended by greatly, often suddenly reduced upper leaves. Species of similar habit, perhaps arbitrarily excluded from ser. *Pectinatae* are *D. cuniculo-caudata* and *D. pulchella*, both technically different in their extremely dense flower-spikes and uniseriate glands in the calyx-membranes. The former differs from sympatric *Pectinatae* of the Transverse Volcanic region in its internally silky bracts (matched in the group only by *D. virgata*, otherwise quite different); the latter by its densely verruculose stems and curiously enlarged first pair of leaflets.

Key to the Species of Ser. *Pectinatae*

1. Interfloral bracts silky-pubescent internally; *calyx-tube* ovate in profile; *keel-blades* ± 5.5–7 mm long; mountains of centr. Oaxaca.
   69. *D. virgata* (p. 326)
1. Interfloral bracts glabrous within; *calyx-tube* campanulate; *keel-blades* 3–5.1 mm long; central and w. Mexico, 1 sp. extending s.-e. into Oaxaca along Sierra Madre del Sur.
   2. Leaves paripinnate, the 12–23 pairs of softly villous-tomentulose leaflets diminishing upward along the rachis, the lowest pair obviously the largest, the terminal one represented by a subulate continuation of the rachis; known only from w. slope of Sierra Madre in Sinaloa and perhaps adjoining Durango.
      68. *D. similis* (p. 324)
   2. Leaves imparipinnate, either tomentulose or glabrous.
      3. Leaflets 7–10 pairs and exactly linear, 10–13 mm long, glabrous; local in Nayarit.
         64. *D. nemaphyllidia* (p. 319)
      3. Leaflets either much more numerous, or much broader, or pubescent.
         4. Tube of the calyx glabrous externally, only the orifice silvery-ciliate; rare spp. of Nayarit and Jalisco.
            5. Leaflets 9–17 pairs and 3–6.5 mm long; known only from Cerro de San Juan near Tepic, Nayarit.
               62. *D. escobilla* (p. 316)
            5. Leaflets 7–9 pairs and 5–11 mm long; Jalisco.
               63. *D. mcvaughii* (p. 318)
         4. Tube of the calyx pilose externally, even though only finely and sparsely so.
            6. Leaflets and stems glabrous or appearing so, the uppermost leaves sometimes bearing a few scattered hairs but the upper leaf-surface always hairless.
               7. Leaflets mostly 16–45 pairs, linear or linear-elliptic; *petals* usually vivid blue, rarely purple.
                  65. *D. pectinata* (p. 320)
               7. Leaflets 12–30 pairs, elliptic to oblong-elliptic, if narrowly elliptic the *petals* pale lilac or whitish.
                  8. Leaflets plane; *epistemonous petals* vivid blue or purple; centr. and s. Mexico, extending n. along Sierra Madre to Durango but there only on the e. slope.
                     61. *D. polystachya* (p. 314)
                  8. Leaflets cymbiform; *epistemonous petals* pale lilac fading (drying) whitish; local on the Pacific slope in Sinaloa (perhaps adjacent Durango) and w. Jalisco.
                     67. *D. crassifolia* (p. 323)
            6. Leaflets on both faces and stems ± pubescent.
               9. Leaflets oblong, flat, green even though finely pilosulous; *plants* up to 1 m tall, the main cauline leaves up to 12 cm long, the leaflets not crowded on the rachis; known only from s. Zacatecas.
                  60. *D. nobilis* (p. 313)
               9. Leaflets linear-involute, gray-pilosulous; *plants* up to 5 dm tall, the main cauline leaves 1–3.5 cm long, the leaflets crowded on the short rachis; local in Jalisco and Michoacán.
                  66. *D. abietifolia* (p. 322)

60. Dalea nobilis Barneby
(Plate LXVI)

Probably suffruticose, possibly shrubby, up to 1 m tall, finely pilosulous throughout with soft, spreading hairs up to 0.35–0.5 mm long, the stems prominently ribbed, eglandular or nearly so, the foliage greenish, the leaflets pubescent both sides, verruculose beneath; *leaf-spurs* less than 1 mm long; *stipules* narrowly subulate, 1.8–2 mm long, becoming dry, fragile, deciduous; *intrapetiolular glands* 0; *post-petiolular glands* small, hemispherical or subimmersed, pilosulous; *main cauline leaves* (lowest not seen) up to 12 cm long, shortly petioled, with broadly green-margined, ventrally grooved rachis and ± 22–27 pairs of broadly oblong to ovate, flat leaflets, the lowest on the rachis largest, up to 6–8 mm long, the rest diminishing upward but the odd one (shortly stalked) slightly longer than the last pair, the upper leaves reduced both in length and in number and size of leaflets; *peduncles* terminal to branches, ± 1 cm long but appearing longer due to suppression of the upper leaves, the last ± 3 nodes marked only by stipules and rudimentary, sessile spikes of imbricated bractlets; *spikes* many-flowered, moderately dense, the calyces when pressed subcontiguous but falling into ± 2 ranks and exposing the villosulous axis, this becoming up to 9 cm long; *bracts* deciduous before anthesis, ovate-caudate, up to 7.5 mm long, the body ovate, boat-shaped, ± 3 mm long and in profile 1.3 mm wide, livid except for pallidly membranous margins, lustrously pilose and gland-sprinkled dorsally, glabrous within; *calyx* at anthesis ± 6.3 mm long (a trifle accrescent thereafter), lustrously pilose with fine straight spreading spiral hairs up to 1.3 mm long, the broadly campanulate, subtumid tube 3.3 mm long, nearly as broad, scarcely recessed behind the banner, the slender ribs livid, prominulous, the membranous pallid intervals charged with many small scattered golden glands, the teeth deltate- to broadly triangular-acuminate, of nearly equal length, the dorsal one ± 3 mm long (slightly shorter than the tube), the ventral pair broadest, all gland-spurred and -tipped; *petals* all purple from the first, the banner charged with a few tiny glands near the eye, otherwise eglandular, the inner petals elevated only 0.3–0.7 mm above the hypanthium-rim; *banner* 7.7 mm long, the claw 4.3 mm, the cordate, hooded blade suberect, 3.5 mm long, nearly as wide, closed at base into a shallow cornet; *wings* 7.5 mm long, the claw 2.8 mm, the oblong blade 4.9 mm long, 2.1 mm wide; *keel* 7.8 mm long, the claws 3 mm, the blades 5.1 mm long, 3 mm wide, united along their outer edges; *androecium* ± 9.4 mm long, 10-merous, the longest filament free for ± 2.7 mm, the anthers ± 0.8 mm long, exserted from the keel at anthesis; *style* at full anthesis exserted ± 3 mm beyond the anthers; *ovules* 2; *pod* broadly obliquely obovoid, compressed, 3.5 mm long, in profile 2.7 mm wide, the style-base subterminal at the upper corner, the valves very thinly papery or at base submembranous, semi-transparent, pilosulous and gland-sprinkled above the middle, the slender prow livid; *seed* ± 2.2 mm long. — Collection: 1 (o).

Open oak-woodland, on rhylolitic substrate, ± 2000 m, known only from the type-locality in the valley of Río Juchipila, a northern tributary of Río Grande de Santiago in the s. prong of Zacatecas. — Flowering January to February.

Dalea nobilis (of noble mien) Barneby, sp. nov., *D. polystachyae* (S. & M.) Barneby manifeste affinis, sed caulibus foliisque undique pilosulis, spica elongata, necnon androecio

elongato antheras ad anthesin ultra carinam proferenti statim separanda. — ZACATECAS: ladera riolítica con vegetación de bosque bajo de *Quercus macrophylla*, 2000 m, Cerro de Piñones, 4 km al W de Pueblo Viejo, mpo de Juchipila, Jan 25, 1964, *Jerzy Rzedowski 18,261*. — Holotypus, ENCB; isotypus, MICH.

This remarkably handsome dalea resembles *D. polystachya* in its many (up to 25 pairs) broad, flat leaflets, in fine detail of the calyx, and in shape of the petals, but may be recognized instantly by the softly pilose stems and herbage, the massive spike of calyces, and the exserted anthers. Ordinarily *D. polystachya* is entirely glabrous below the flower spikes, but the caudex rarely gives rise, late in the season, to thinly pilosulous sterile shoots bearing short, comparatively simple leaves. If the same type of pubescence were to extend upward along the flowering stems and adult foliage, the plant would resemble *D. nobilis* closely, but nothing of the sort is known at present. Mention has been made under *D. polystachya* of what is believed to represent a large-flowered phase which was described by Rydberg as *Parosela lagopina*. The typus of the latter, not since exactly matched, resembles *D. nobilis* in the proportions of the spike; unfortunately the flower is unknown at anthesis, so that the proportions of calyx to petals and androecium and the position of the anthers cannot be compared with those of *D. nobilis*. The androecium of *D. lagopina* is very long (± 11 mm after fall of the petals), so that the anthers may very well be exserted as in the present species; but the plant is glabrous to the spikes, in practice therefore easily separable. The keel and wings of *D. nobilis* are inserted on a column less than 1 mm distant from the hypanthium-rim, much closer to the floor of the calyx than those of any known form of *D. polystachya* or of so-called *P. lagopina*.

61. DALEA POLYSTACHYA (Sessé & Mociño) Barneby
(Plate LXVII)

Herbaceous or feebly suffruticose, 8–18 dm tall, from a stout woody perennial root, glabrous to the inflorescence or (rarely) the base of the stems late in the dry season giving rise to gray-villous spurs bearing short leaves (leaflets 2–4 pairs), the flowering stems solitary in young plants but later 2–several, virgately erect and ascending, striate, eglandular or very sparsely microglandular, usually purplish, densely leafy (but the leaves drought-deciduous), passing upward into an openly few-branching, sparsely leafy panicle of spikes, the foliage green, the leaflets usually of rather thick texture, paler and punctate beneath; *leaf-spurs* small but prominent, up to 0.5 mm long; *stipules* subulate or triangular, 0.5–2.5 mm long, purplish and subglandular becoming dry and early deciduous; *intrapetiolular glands* 0; *post-petiolular glands* prominent, rounded, pale or orange; *main cauline leaves* 3–9 (11) cm long, very shortly petioled or subsessile, with (8) 12–20 (23) pairs of oblong to oblong-elliptic, obtuse, emarginate, or obtuse and bluntly gland-mucronulate, flat leaflets (1) 2–6 mm long; *peduncles* terminal to all branchlets of the panicle, 0.5–7.5 cm long, mostly appearing longer because of suppression of upper leaves; *spikes* oblong-ovoid, becoming ovoid to cylindroid, in fruit only moderately dense, without petals 8–12 (13) mm diam, the densely pilosulous axis becoming 1–5 (8) cm long; *bracts* deciduous, ovate to lance-acuminate or -caudate, 3–6 mm long, the median and upper ones scarious-margined at base, the tips livid, all pilosulous dorsally at base or throughout, gland-charged distally, glabrous within; *calyx* 4–5.6 mm long, sessile, densely pilose with weak, spiral hairs up to (0.8) 1–1.3 mm long, the tube 2.2–3 mm long, oblique at mouth but the dorsal sinus not strongly recessed, the ribs slender, livid, the membranous

intervals sprinkled with many small, scattered, yellow glands, the triangular-aristate, gland-spurred teeth somewhat unequal, the dorsal one narrowest and longest, (1.3) 1.7–2.8 mm long, (1) 0.6 mm shorter to 0.4 mm longer than the tube; *petals* either bright blue or rose-purple, the banner with a pale, commonly gland-sprinkled, finally rubescent eye, the banner sometimes charged with a minute terminal gland, the keel-tip glandless, the inner petals elevated ± 1.6–2.4 mm from the hypanthium rim, the keel-blades united by their outer edges; *banner* 5–6.9 mm long, the claw 2.5–4.3 mm, the deltate-obcordate blade 2.7–3.7 mm long, 2.8–4 mm wide; *wings* 4.2–6.8 mm long, the claw 1.6–2.6 mm, the obliquely oblong-obovate or -ovate blade 2.7–4.2 mm long, 1.6–2.6 mm wide; *keel* 6–8.2 mm long, the claws 2.3–4.6 mm, the broadly obovate blades 3.6–5 mm long, 2–2.9 mm wide; *androecium* 10-merous, 6.5–7.8 mm long, the longest filament free for (1.5) 1.8–2.8 mm, the connective gland-tipped, the anthers 0.5–0.75 mm long; *pod* obliquely ovoid, 2.8–3 mm long, the style-base terminal but excentric, the valves hyaline at base, beyond the middle thinly papery, pilosulous, and minutely gland-sprinkled, the keels subfiliform. — Collections: 16 (iii).

Dry sunny hillsides in oak woodland and sometimes on cooler slopes of barrancas in either oak-brush or oak-pine woodland, 1530–2400 m, local and usually occurring in small numbers but widely distributed through the Transverse Volcanic Belt from s.-e. Estado de México to w. Jalisco and adjoining Aguas Calientes, and along the Sierras Madre Occidental and Sur from central Durango and adjoining Sinaloa to Guerrero. — Flowering October to March. — *Representative*: MÉXICO: 7 mi NE of Temascaltepec, *Gentry, Barclay & Arguelles 19,605* (RENNER, US); Tejupilco, *Hinton 2720* (K, US); Valle de Bravo, *Ripley & Barneby 14,892* (CAS, DAO, GH, MEXU, MICH, US). MICHOACÁN: Cerro Azul near Morelia, *Arsène 8457* (BR, F, US); 8 mi s. of Uruapan, *Ripley & Barneby 14,098* (CAS, NY, US). JALISCO: Sierra del Halo, *Koelz 34,142* (ENCB, MICH); Altenguillo to Jacala (typus of *P. longifolia*). AGUAS CALIENTES: Sierra del Laurel near Cadrillo, *Rzedowski 14,102* (ENCB, MICH). DURANGO: 5½ mi e. of El Salto, ± 55 mi w.-s.-w. of Ciudad Durango, *Waterfall 13,619* (OKLA, US); Sierra Madre, perhaps in Sinaloa (typus of *P. roseiflora*). GUERRERO: near Chilapa (typus). OAXACA: Miahuatlan to San Andrés, pacific slope, *Liebmann 4608* (F, US).

Dalea polystachya (Sessé & Mociño) Barneby, comb. nov., based on *Psoralea polystachya* (with many spikes) S. & M., Fl. Nov. Hisp. 121. 1889 ("*polistachia*"). — "Habitat in Chilapae montibus [Guerrero]." — Lectotypus, labelled "*Psoralea Polystachia* N[obis]", herb. Sessé & Mociño *No. 2656*, MA! isotypus (fragm.), F!

Parosela lagopina (resembling a hare's-foot, of the silky flower spikes) Rydb., N. Amer. Fl. **24**: 72. 1920. — "Type collected at Chacala, Durango, March 7, 1899, *Goldman 357*..." — Holotypus, US! isotypi, GH, NY! — *Dalea lagopina* (Rydb.) Gentry, Madroño **10**: 249. 1950.

Parosela roseiflora (pink-flowered) Rydb., N. Amer. Fl. **24**: 105. 1920. — "Type collected in Sierra Madre (Sinaloa or Durango), *Seemann*..." — Holotypus, GH! isotypus, K! — *Dalea roseiflora* (Rydb.) Riley, Kew Bull. **1923**: 337. 1923.

Parosela longifolia (long-leaved) Rydb., N. Amer. Fl. **24**: 105. 1920. — "Type collected on the road from Altenguilla to Jacala, Jalisco, March 5, 1897, *E. W. Nelson 4016*..." — Holotypus, US! isotypus, NY!

Useful diagnostic characters of *D. polystachya* are the tall, virgate stems, striate but not or scarcely gland-verruculose, which arise anew each year from near soil-level or from a weakly developed caudex; the many (mostly 12–20 pairs of) flat oblong leaflets, quite glabrous except on rare basal offsets arising in late autumn or winter; and the moderately

dense spikes of silvery-villous calyces subtended by deciduous, internally glabrous bracts. The species is widely dispersed through south and south-west Mexico, but seems not to be abundant anywhere; in each of three stations known to me only a few plants were found. The petals may be either bright blue or rose-purple, but the color-types are not geographically segregated and seem taxonomically insignificant. The purple form appears to predominate in the Sierras Madre Occidental and Sur, but has been found close to the blue form in southeast México (cf. *Gentry et al. 19,605*, from n.-e. of Temascaltepec and *Hinton 2720* from Tejupilco). Both occur in central Michoacán (near Morelia, purple, near Uruapan, vivid blue), and near the Sierra crest in western Durango. The species is partly sympatric with the related *D. pectinata*, but is easily separated by the broad and flat, not linear-elliptic and comblike leaflets. Differential characters of the more closely related *D. nobilis* and *D. escobilla* are discussed under these headings.

Of the modern synonyms cited above, *P. roseiflora* and *P. longifolia* were clearly based on minor variants of one species. Rydberg possessed only incomplete material of either, and with the passage of time the supposed differences (Rydberg, 1920, p. 71, in clave) involving relative length of bracts, calyx-tube, and teeth, have fallen into perspective as part of a variational range normal in *Dalea*. The case of *P. lagopina* is different. The typus of the latter consists of summit branchlets gathered in early March when the main flowering season was long past, the flower described by Rydberg being, I believe, only a tardy bud. The protologue pictures *P. lagopina* as a coarse annual related to Rydberg's *P. lagopus* (= *Dalea exserta* of this paper), but nothing in the specimen supports this view of its relationship or duration. So far as can be seen, the foliage and inflorescence accord well enough with the present concept of *D. polystachya*, except that the main spikes (central, I suppose, to a panicle of several), is uncommonly long (reaching 8 cm) and the fruiting calyx is large, ± 7 mm long (tube 4.7–5 mm, teeth 1.7–2.1 mm) and becomes tumid and oblong-ellipsoid eventually (cf. Plate LXVII fig. 6c). Further, the vesture of the calyx is relatively short (hairs up 0.5 mm), and the androecium longer (± 11 mm) than seen elsewhere in genuine *D. polystachya*. No rational decision can be reached about the status of *D. lagopina* until more complete material becomes available. It may yet prove to be a distinct entity related not only to *D. polystachya* but also to *D. nobilis* (q.v.), of which it may conceivably prove to be a vegetatively glabrous variant.

See also a comment on *Dalea hypoglottidea* DC. in Appendix I.

62. Dalea escobilla Barneby
(Plate LXVIII)

Tall herbs, glabrous to the inflorescence, with 1–few virgately erect and assurgent stems from carrotlike root, at anthesis 7–10 dm tall, the stems striate, smooth or obscurely glandular distally, sparsely leafy, above the middle branching into an almost leafless panicle of spikes; *leaf-spurs* very small; *stipules* deltoid, very small, livid and subcarnose, becoming dry and deciduous; *main cauline leaves* 3–8 cm long, with very narrowly margined rachis and 9–17 pairs of broadly oblong to ovate-oblong, obtuse to emarginate, flat leaflets 3–6.5 mm long, these smooth and green above, gland-punctate beneath; *peduncles* slender, 2–10 cm long; *spikes* short and rather loose, (10) 15–30-flowered, the densely villosulous axis becoming 6–12 mm long; *bracts* early deciduous, ovate-acuminate, ± 1–4 mm long, ciliolate at base and apex, glabrous and glandular dorsally; *calyx* 2.7–3.3 mm long, glabrous externally up to the densely ciliolate orifice, the tube 1.9–2.2 mm long, the ribs very slender, black or livid, the membranous intervals charged with scattered golden glands, the broadly triangular to deltate, apiculate and gland-spurred teeth unequal, the dorsal one longest,

0.9–1.2 mm long, the orifice subsymmetrical; *petals* bicolored, the banner opening whitish sometimes with purple tip and lobes but fading reddish, the inner rose-purple, elevated 0.7–1.2 mm above the hypanthium rim, the banner gland-sprinkled in the eye but no petals gland-tipped; *banner* 4.2–4.5 mm long, the claw 1.5–2.2 mm, the deltate-cordate blade hooded and obtuse at apex, closed at base into a shallow cornet, 3.1–3.3 mm long, ± 3 mm wide; *wings* ± 4.8 mm long, the claw 1.7 mm, the elliptic blade 3.6–4 mm long, 2 mm wide; *keel* ± 5.3 mm long, the claws ± 1.6 mm, the blades 4–4.4 mm long, 2.5 mm wide, united by their outer edges; *androecium* 10-merous, 5.7–6.5 mm long, the longest filament free for 1.8–2 mm, the connective gland-tipped, the anthers 0.5–0.65 mm long; *pod* obovoid, strongly compressed, ± 2.5 mm long, thick-crested dorsally, the ventral keel and prow subfiliform, the valves hyaline in lower half, thence thinly papery, glandular, pilosulous; *seed* ± 1.7 mm long. — Collections: 2 (o).

Sunny openings in oakwoods, sometimes in "thin soil overlying pumice", 1000–1700 m (3330–5660 ft), known only from the slopes of Cerro de San Juan, s.-w. of Tepic, Nayarit. — Flowering September onward. — Material examined: cf. below.

Dalea escobilla (the vernacular name) Barneby, sp. nov., *D. polystachyae* (S. & M.) Barneby et *D. mcvaughii* Barneby affinis, forsan huic propior, ab illa calycis extus glabri tantum ad orem brevidentatum intus sericeo-ciliolati dentibus triangulari-deltatis ad 0.9–1.2 (nec 1.7–2.8) mm longis, a *D. mcvaughii* quoad calycem extus nudum simili imprimis foliolis foliorum majorum (more *D. polystachyae*) numerosis (9–17 nec 7–9-jugis), spicis laxioribus paucifloris, calycisque dentibus brevioribus statim separata. Herbacea elata uni- vel paucicaulis infra spicas glaberrima, habitu foliisque multifoliolatis *D. polystachyam* simulans. — NAYARIT: sunny opening in woods, 1000 m, Cerro de San Juan; w. of Tepic, Sept 19, 1926, *Ynez Mexia 704.* — Holotypus, NY; isotypi, BM, CAS, G, GH, MICH, UC, US. — Ibid., *Pennell 19,979*; paratypi, GH, US.

This species and the next in order, *D. mcvaughii*, together differ from other known *Pectinati* in the externally glabrous, lustrously membranous calyx furnished around and within the orifice with a dense fringe of short silky hairs. They are a closely related pair, so far as known vicariant in dispersal on well-isolated mountain ranges forming part of the western arm of the Transverse Volcanic Belt, and differ most notably in number of leaflets, these being numerous (mostly 10–17 pairs) and also small (3–6.5 mm) in *D. escobilla*, relatively few (7–9 pairs) and larger (5–11 mm) in *D. mcvaughii*. The calyx-teeth of *D. escobilla* are a little shorter, a difference that may well disappear as more collections become available for study, and its spikes seem to be both looser and fewer-flowered. The collective range of the two species lies within that of the wisely dispersed and closely related *D. polystachya* (S. & M.) Barneby, the flower of which is essentially similar except that the calyx is hairy from the base upward. In the number and size of leaflets *D. escobilla* and *D. polystachya* are alike, but the calyx-teeth of *D. escobilla* are absolutely and decisively shorter (0.8–1.2 not 1.5–2.8 mm long). If the pubescence-character of the calyx, always under suspicion in *Dalea*, were disregarded in this case, *D. escobilla* would be accomodated without strain within an only slightly enlarged concept of *D. polystachya*. It would then become difficult to exclude *D. mcvaughii*, despite its few leaflets, and this would lead in turn to an altogether unwieldy and unrealistic taxonomy. It seems likely that *D. mcvaughii* and *D. escobilla* are indeed recent derivatives of *D. polystachya*, perhaps not ideally characterized as yet but (until we have evidence to the contrary) abruptly and visibly different from it and from each other.

The term *escobilla*, little broom, is applied to many Mexican daleas, in the first place to those which furnish the flexible but tough, twiggy stems that are tied in bunches and, fixed to a pole, make serviceable besoms, but ultimately becomes a generic term. Mexia records the usage for this species in Nayarit.

63. Dalea mcvaughii Barneby
(Plate LXIX)

Slender, virgately erect perennial herbs 7–10 dm tall from a knotty, fusiform, woody root, glabrous to the inflorescence, the solitary, striate, eglandular stem at anthesis leafless at base, simple and leafy thence to beyond the middle, paniculately branched and almost leafless distally, the spikes terminal to all the branchlets of the open panicle, the foliage green, the firmly membranous leaflets slightly paler and finely punctate beneath; *leaf-spurs* obscure or short, up to 0.6 mm long; *stipules* deltate-subulate, 0.4–1.6 mm long, livid-castaneous early becoming dry and deciduous; *intrapetiolular glands* small, impressed or nearly so; *post-petiolular glands* prominent but low and obtuse, small; *main cauline leaves* (drought deciduous) 3–5 cm long, very shortly petiolate or subsessile, with narrowly margined, ventrally grooved rachis and 7–9 pairs of well-spaced, oblanceolate to broadly oblong-elliptic, obtuse or subacute, flat or loosely folded leaflets 5–11 mm long, the leaves toward the inflorescence smaller, with fewer, shorter leaflets, the uppermost ones often minute or suppressed; *peduncles* slender, 3.5–12.5 cm long; *spikes* dense but not conelike, the principal ones ± 30–50-flowered, the calyces subcontiguous, without petals ± 1 cm diam, the villosulous axis 1–2 cm long; *bracts* early deciduous, above the pallid cuneate base livid, lanceolate to lance-caudate, 2–3.5 mm long, pilosulous but not glandular dorsally, ciliolate, glabrous within; *calyx* (sessile) 3.9–4.6 mm long, glabrous below the orifice, this densely fringed and the teeth ciliolate with fine, soft hairs up to ± 0.4 mm long, the membranous tube 2.4–2.5 mm long, not at all pleated, the filiform ribs livid or black, the broad, plane intervals charged with many small, scattered or irregularly biseriate, honey-colored glands, the teeth subulate or linear-subulate above their broad deltate base, the dorsal one longest, 1.4–2.2 mm long, either erect or (when long) recurved, the ventral pair shortest; *petals* vivid violet-purple, the banner-blade with central white (glandless) eye-spot or white (rubescent) with purple tip and basal lobes, the inner petals perched 0.8–1.6 mm above hypanthium rim, the keel-blades united by outer margins; *banner* 5.1–6.3 mm long, the slender claw 3.3–3.5 mm long, the deltate-cordate blade 2.7–2.9 mm long, 2.4–3 mm wide, closed at base into a shallow cornet; *wings* ± 5.5 mm long, the claw 1.6 mm, the oblong-obovate blade 4.3 mm long, 1.9 mm wide; *keel* ± 7 mm long, the claws 2.7 mm, the broadly elliptic blades 4.6 mm long, 2.6 mm wide; *androecium* 10-merous, 7–7.4 mm long, the longer filaments free for 2.2–2.4 mm, the connective gland-tipped, the dark-purple finally bluish anthers 0.5–0.55 mm long; *pod* obliquely triangular-obovate in profile, 2.8 mm long, the style-base terminal, the keels all very slender, the papery-membranous, semitransparent valves livid distally, finely pilosulous above middle and charged with small, scattered, honey-colored glands; *seed* (unripe) ± 1.5 mm long. — Collections: 2 (o).

Steep open hillsides in pine or pine and oak forest, 1450–2200 m (± 4830–7330 ft), locally abundant, known from two localities in the w. extremity of the Transverse Volcanic Belt in Sierras del Tigre and del Parnaso, in e.-centr. and w. Jalisco. — Flowering mid-September to November. — *Material*: cf. below.

Dalea mcvaughii (Rogers McVaugh, 1909–) Barneby, sp. nov., juxta *D. escobilla* Barneby collocanda, imprimis foliolis foliorum majorum 7–9 (nec 9–17)-jugis, spicis multifloris magis confertis, necnon dentibus calycinis longioribus (dorsali 1.4–2.2 nec 0.9–1.2 mm longo) absimilis. Ab affini *D. polystachya* (S. & M.) Barneby etiam multifoliolata calyce extus glabro ad orem tantum barbulato, a *D. cuniculo-caudata* Wilson spica minus densa, calyce extus bracteaque sua intus glabris, petalisque eglandulosis longius distat.

Herba elata saepe (?semper) monopodialis infra spicas glaberrima, tubo calycino extus glabro lucido inter affines (cum *D. escobilla*) notabilis. — JALISCO. Sierra del Tigre, 3 mi s. of Mazamitla, Sept 18, 1952, *Rogers McVaugh 13,036*. — Holotypus, MICH. — 4.5 mi n.-n.-e. of Talpa de Allende, Oct 17, 1960, *Rogers McVaugh 20,355*; paratypus (fruct.), MICH.

A graceful monopodial dalea, with slender, glandless stem branching distally into an open, thinly leafy or almost leafless panicle of ovoid spikes. The close relationship of *D. mcvaughii* to *D. escobilla* and through *D. escobilla* to *D. polystachya* is discussed under the preceding species. The relatively few leaflets of the main stem-leaves suggest comparison with the habitally similar *D. cuniculo-caudata* Wilson, found in the same vegetation belt on the south and west slopes of Nevado de Toluca, distant at least 250 km eastward from Sierra del Tigre. This differs in its denser, conelike flower-spikes, internally silky bracts, and calyx silky-barbate from the base upward. The petals of *D. cuniculo-caudata* are conspicuously gland-tipped, those of *D. mcvaughii* glandless.

It is a pleasure to associate with this attractive plant the name of its discoverer, Rogers McVaugh, a name already imperishably connected with the flora of southern Mexico in general and of Jalisco in particular.

64. DALEA NEMAPHYLLIDIA Barneby

(Plate LXVIII)

Herbaceous, perennial, up to ± 1 m tall, the slender, virgately erect stems brownish-stramineous charged with small impressed orange glands but not verruculose, at anthesis leafless at base and beyond the middle where branching into panicle of spikes, wholly glabrous below the inflorescence, the foliage glaucescent, the leaflets livid-punctate beneath; *leaf-spurs* very short; *intrapetiolular glands* 0 or minute; *post-petiolular* glands subimpressed; *main cauline leaves* ± 3–4 cm long, subsessile, with narrowly margined, punctate rachis and 7–10 pairs of narrowly linear, obtuse, involute and so subcylindric but ventrally grooved leaflets 10–13 mm long, the rameal leaves shorter, with fewer leaflets of same type, the uppermost leaves nearly or quite suppressed; *peduncles* slender, divaricate and incurved, 6–14 cm long; *spikes* shortly but rather loosely 15–25-flowered, without petals ± 10 mm diam, the densely silky-villosulous axis less than 2 cm long; *bracts* early deciduous, the lowest broadly the upper narrowly lance-acuminate, 2.5–4 mm long, thinly pilosulous and gland-pustulate dorsally, pallid at base, livid distally, glabrous within; *calyx* sessile or nearly so (the pedicel sometimes up to 0.4 mm long), 4–4.4 mm long, the thinly villosulous tube 2–2.4 mm long, not recessed behind the banner, the ribs slender, livid, the membranous intervals charged with scattered glands, the triangular-subulate, gland-spurred teeth densely silky-ciliolate within and around the orifice, the dorsal tooth slightly longer than the rest, ± 2 mm long; *petals* opening bicolored, the banner whitish, rubescent in age, the inner petals violet or purple, all eglandular, the inner elevated ± 1.5–2 mm above hypanthium rim, the keel-blades united by their outer edges; *banner* ± 5 mm long, the claw nearly 2.5 mm, the cordate, hooded blade ± 3.5 mm long, nearly as wide, recurved through nearly 90°; *wings* ± 4.5–4.8 mm long, the claw 1.4–1.8 mm, the elliptic blade 3.5–3.8 mm long, ± 1.6 mm wide; *keel* 5.3–5.8 mm long, the claws 1.7–2.1 mm, the ovate-elliptic blades 4–4.4 mm long, ± 2.4 mm wide; *androecium* 10-merous, ± 5.5–6 mm long, the longest filament free for ± 2 mm, the connective gland-tipped, the anthers ± 0.6 mm long; *pod* triangular-obovate in profile, ± 2.7 mm long, the style-base latero-terminal, the dorsal crest moderately

thickened, the ventral suture and prow slender, the valves hyaline below the middle, thence thinly papery, villosulous, and sparsely gland-sprinkled; *seed* ± 1.7 mm long. — Collections: 1 (o).

Pine forest, at ± 1200 m (4000 ft), known only from the type-locality on the headwaters of Río Ameca in interior Nayarit. — Flowering September to November.

Dalea nemaphyllidia (with threadlike leaflets) Barneby, sp. nov., *D. pectinatae* Kunth et *D. escobilla* Barneby verosimiliter affinis sed ab ea imprimis foliolis paucis (7–10 nec 16–45-jugis) 2–3-plo longioribus, ab hac foliolis paucis simul ac angustissime linearibus involutis subcylindricis (nec oblongis planis) manifeste discedens. Herbae submetrales infra spicas glaberrimae, caulibus ad medium densiuscule foliatis in paniculam subcorymbosam fere nudam abeuntibus; flos fere is *D. escobilla* nisi calycis tubo extus parce villosulo, dentibus paullo longioribus, vexilloque eglanduloso absimilis. — NAYARIT: flanks of mountains, in pine-forest, 1200 m, trail from Yxtlán to Juanacata, Oct 2, 1926, *Ynez Mexia 900.* — Holotypus, CAS; isotypi, G, GH, NY, UC.

In fundamental characters and in general growth-habit this elegant and strongly characterized dalea resembles *D. pectinata, D. polystachya*, and their allies, but differs from all in the relatively few (7–10) pairs of very long, narrow leaflets which are so strongly involute as to become almost cylindric in section, although preserving a narrow groove along the ventral face. Only *D. pectinata* has (sometimes) leaflets at once as narrow and glabrous, but they are then much shorter (at most 4, not 10–13 mm long) and, at least in main cauline leaves, about 16–40 pairs. The inflorescence of *D. nemaphyllidia* suggests a close relationship to *D. escobilla*, a second species highly localized in Nayarit and, by coincidence, also first collected by Ynez Mexia, only a few days earlier. This differs most obviously in its many broad, flat leaflets; furthermore the calyx is glabrous externally and more shortly toothed.

I have not identified positively the "Juanacata" of Mexia's label but suppose it to be the Juanacatlán lying about 60 km SW of Yxtlán del Río in municipio Mascota, Jalisco. The type-locality is said, however, to be in Nayarit. hence probably on the right bank of Río Ameca s.-w. of Yxtlán.

65. DALEA PECTINATA Kunth
(Plate LXX)

Perennial herbs, sometimes weakly suffrutescent in age, glabrous to the inflorescence or very rarely thinly villosulous distally, the 1–many terete or striate, stramineous or purplish, erect or virgately ascending stems (4) 5–13 dm tall, sparsely charged with immersed or some more prominent but never conspicuous glands, simple and leafy in the lower ⅔–¾, thence paniculately or subcorymbosely branched, the foliage green or subglaucescent, the very numerous small leaflets punctate beneath; *leaf-spurs* very short or 0; *stipules* narrowly triangular to linear-subulate, livid, becoming dry and fragile in age; *intrapetiolular glands* 0 or minute; *post-petiolular glands* orange, not very prominent; *leaves* sessile or almost so, 1.5–5.5 cm long, with narrowly margined rachis and (8) 16–45 (48) pairs of linear to linear-oblong, obtuse or emarginate, involute leaflets 0.5–4 mm long crowded (0.5–2 mm apart) along the rachis on petiolules 0.1–0.45 mm long; *peduncles* 1–7 cm long (sometimes appearing longer due to suppression of upper leaves); *spikes* moderately dense, the flowers mostly 2–3-ranked when pressed, ovoid-conic or depressed-ovoid becoming cylindroid, with-

out petals or androecia 7.5–10 mm diam, the densely villosulous axis becoming 0.3–6, mostly 0.5–2.5 cm long; *bracts* early deciduous, ovate or lance-acuminate, 2–3.5 mm long, livid, dorsally glandular, the lowest glabrous but the rest hirsutulous at least at base, sometimes nearly throughout, but the tips commonly glabrous; *calyx* densely silky-pilosulous with silvery hairs, 3.8–4.9 (5.8) mm long, the tube 2.2–2.5 (2.7) mm long, the brownish, subfiliform ribs not strongly salient, the membranous intervals charged with ± 2 irregular rows of small orange or yellowish glands, the triangular-acuminate, gland-spurred and -tipped teeth 1.2–2.2 (3.1) mm long, the dorsal one usually a little longer than the rest, only exceptionally longer than the tube; *petals* monochrome or somewhat bicolored, the banner then with a white but rubescent eye or transverse band, the epistemonous ones blue to blue-violet, rarely rose-lavender, perched much below middle of androecium, the banner sometimes charged with a gland-crescent and the inner petals rarely gland-tipped; *banner* 5.4–7.3 mm long, the claw 3–3.8 mm, the deltate-cordate blade 2.3–4 mm long, 3–4.2 mm wide; *wings* 5.1–8 mm long, the claw 1.8–3.3 mm, the ovate-elliptic blade 3.7–5 mm long, 1.8–2.5 mm wide; *keel* 6–7.4 mm long, the claws 2.3–3.2 mm, the broadly ovate blades 4.1–5 mm long, 2.6–3 mm wide; *androecium* 10-merous, 6.5–9.6 mm long, the longer filaments free for 1.4–2.4 mm, the connective gland-tipped; *pod* in profile obliquely obovate, 2.7–3 mm long, the style-base latero-terminal, the sutures subfiliform, the valves membranous at base, finely pilosulous and gland-sprinkled distally; *seed* 2–2.4 mm long; $2n = 14$, 7_{II} (Mosquin). — Collections: 37 (vi).

Rocky hillsides in grassland and climbing into oak-madroño and pine-oak woodland, 1500–2550 m (± 5000–8500 ft), locally plentiful and rather common around the w. and s. margins of the Meseta Central from s.-centr. Durango to s.-e. Nayarit (Sa. de Palomas) and e. through Guanajuato into s. San Luis Potosí, in Jalisco descending to ± 1300 m in the barrancas of Río Santiago downstream from Guadalajara and reappearing locally in w. Cordillera Neovolcánica (near Etzatlán and Cuautla). — Flowering July to October (November). — *Representative*: DURANGO: *Gentry 6904* (F, GH, NY, US); *Mosquin et al. 6833* (NY); *Ripley & Barneby 13,482* (CAS, NY, MEXU), *14,190* (NY, US). ZACATECAS: *McVaugh 17,714* (MICH); NAYARIT: *Schubert & Souza 2059* (NY). JALISCO: *Pringle 3835* (BR, F, NY, MEXU, UC, W, Z); *Waterfall 13,833* (F, OKLA); *McVaugh 13,665* (MEXU, MICH); *Ripley & Barneby 14,134* (CAS, DAO, NY). GUANAJUATO: *Kenoyer 2428* (GH); *Ripley & Barneby 13,370* (CAS, MEXU, MICH, NY, US). SAN LUIS POTOSÍ: *Parry & Palmer 146* (BR, F, NY, US).

Dalea pectinata (comblike, of the many, close-set leaflets) Kunth, Mimoses 169, pl. 49. 1819. — "Crescit in collibus prope Villalpando [Guanajuato] Mexicanorum, alt. 1330 hex." — Holotypus, P (herb. H. B. K. *4220*)! — *Parosela pectinata* (Kunth) Rose, Contrib. U. S. Nat. Herb. **10**: 104. 1906.

An attractive plant, notable for the ferny foliage, the leaves composed of very numerous (often 40–90) small narrow leaflets crowded along the rachis. All kindred or habitally similar species have leaflets either fewer, or broader, or pubescent. In general organization and stature *D. pectinata* resembles *D. polystachya*, the foliage of the virgate stems being abruptly reduced in amplitude where the primary axis branches into a panicle of rather loose narrow spikes. In both species the petals may be either blue or rose-purple, but in *D. pectinata* are usually a rich and vivid blue that turns violet-blue in drying. The peculiar grace and character of *D. pectinata* is superbly rendered in Turpin's plate accompanying the protologue.

66. Dalea abietifolia (Rose ex Rydberg) Bullock
(Plate LXXI)

Perennial from a woody taproot, villous-tomentulose throughout with fine, weak, contorted hairs, the few, simple, erect, herbaceous stems 3.5–4.5 dm tall, subterete and almost eglandular, densely leafy to or beyond the middle, at top subcorymbosely or paniculately branched, the upper leaves abruptly reduced in size, the spikes terminal to the branchlets, the foliage gray or canescent, the leaflets pubescent both sides, dotted beneath; *leaf-spurs* very short, mostly less than 0.5 mm; *stipules* linear or subulate, recurved, 1.5–2 mm long, glabrate, livid, fragile in age; *intrapetiolular glands* 0; *post-petiolular glands* small, impressed or if slightly raised concealed by pubescence; *main cauline leaves* 1–3.5 cm long, subsessile, with narrowly margined rachis and 12–18 pairs of subsessile, crowded linear-involute, obtuse or bluntly gland-mucronulate leaflets 2–7.5 mm long, obtusely carinate dorsally by the castaneous midrib, inserted ± 1–2 mm apart along the rachis, the terminal one smallest; *peduncles* appearing 3–12 cm long, often shorter, but the upper leaves suppressed; *spikes* ovate or depressed-capitate, moderately dense, without petals ± 9 mm diam, the villosulous axis ± 5–15 mm long; *bracts* deciduous, narrowly lanceolate or subulate, 2–3 mm long, villosulous dorsally, glabrous within, livid-tipped; *calyx* densely silky-pilosulous externally, 3.7–5 mm long, the tube 2–2.5 mm, oblique at mouth but not strongly recessed behind the banner, the ribs brown, slender but somewhat raised, the membranous intervals charged with ± 3, uniseriate, always small, yellowish glands scarcely visible externally, the triangular-acuminate, gland-spurred teeth unequal, the dorsal one longest, 1.7–2.5 mm long; *petals* opening bicolored, the banner whitish but early rubescent, the inner ones rose-purple, elevated not more than 2 mm above the hypanthium, all glandless; *banner* 4.5–4.8 mm long, the claw 2.5–3 mm, the deltate-cordate, somewhat hooded blade 2.5–2.9 mm long, 2.4–2.8 mm wide, closed at base into a shallow cornet; *wings* 4.8–5 mm long, the claw ± 1.8 mm, the blade 3.4 mm long, 1.5–1.7 mm wide; *keel* 5.6–6.4 mm long, the claws 2.5–3.1 mm, the broadly ovate blades 3.2–3.8 mm long, 2.2–2.4 mm wide; *androecium* 6–7 mm long, the longest filament free for ± 1.8 mm. — Collections: 3 (o).

Open places in the oak-belt, sometimes on "dry, chalky hilltops", rare and local, known only from Etzatlán, Jalisco (± 70 km w. of Guadalajara), and Cerro Azul, ± 22 km s.-e. of Morelia, Michoacán. — Flowering in October to December. — *Material*: Jalisco. Etzatlán, *Barnes & Land 295* (F, K, doubtless exact topotypes, as the collectors visited Etzatlán in Pringle's company). Michoacán. Cerro Azul, *Arsène in 1912* (L).

Dalea abietifolia (Rose ex Rydb.) Bullock, Kew Bull. **1939**: 194. 1939, based on *Parosela abietifolia* Rose ex Rydb., N. Amer. Fl. **24**: 92. 1920. — "Type collected on dry chalky summits of mountains above Etzatlan, Jalisco, October 27, 1903, *Pringle 8774*..." — Holotypus, US! isotypi, F, GH, K, L, M, MEXU, NY, UC, W, Z!

This strongly characterized species is recognized at sight by the elaborate, gray-tomentulose foliage. In its range of dispersal only the related *D. pectinata* has nearly as many or as crowded leaflets, but these are glabrous and elliptic or linear-elliptic rather than truly linear in outline, and shorter or at least shorter in proportion to the length of the leaf. The stems of *D. pectinata*, which was collected by Pringle close to the type-locality of *D. abietifolia*, are commonly taller, 6–15 rather than 4–5 dm long. The only related dalea which has tomentulose leaflets twelve or more to the leaf is the geographically remote *D. similis*, apparently endemic to the Sierra Madre Occidental in Durango. This is a much taller plant, with longer spikes, paripinnate leaves, and a calyx-tube deeply recessed behind the gland-sprinkled banner.

67. DALEA CRASSIFOLIA Hemsley
(Plate LXXI)

Tall suffruticose herb with a woody root up to 1–1.5 cm diam just below the crown and 1–several erect or virgately ascending stems up to 8–15 dm long, glabrous to the spikes, the striate, sparsely gland-sprinkled stems simple and rather densely leafy up to the middle or beyond, paniculately branching distally and the foliage abruptly reduced in the inflorescence, the leaflets thick-textured, bicolored, green above, pallid-glaucescent and strongly gland-dotted beneath; *leaf-spurs* very short or obsolete; *stipules* triangular-subulate, livid, up to 1 mm long, deciduous; *intrapetiolular glands* minute, impressed; *post-petiolular glands* small but prominulous, obtuse or lens-like, orange; *main cauline leaves* (drought-deciduous, largely shed by late anthesis) 4–7.5 cm long, with narrowly thick-margined, gland-dotted rachis and (10) 17–27 (33) pairs of rather crowded, elliptic or oblong-elliptic, obtuse but dorsally gland-mucronulate, shallowly boat-shaped, dorsally keeled leaflets 1.5–4.5 (5) mm long, the uppermost leaves shorter, with fewer leaflets of the same type but smaller; *peduncles* terminal to branches of the panicle, the one central one leaf-opposed, mostly 1.5–5 cm long but often appearing longer due to reduction (or suppression) of the uppermost leaves; *spikes* densely many-flowered, cylindric or becoming so, without petals or androecia 9–11 mm diameter, the densely pilose axis becoming 1.5–5.5 cm long; *bracts* deciduous, narrowly lance-acuminate or -caudate, the lowermost (sometimes persistent) glabrous dorsally, the rest villosulous dorsally, glabrous within, all livid-nigrescent distally, charged with small livid or orange glands, the tail surpassing the flower-buds; *calyx* 5–7.2 mm long, densely silky-pilose externally with ascending, finally spreading and plumose, spiral hairs up to 1–1.4 mm long, the tube 2.2–2.7 mm long, the ventral sinus recessed behind the banner (the orifice thus oblique), the orange or livid ribs slender becoming prominent, the membranous intervals charged with irregularly seriate, small yellow glands, the triangular-acuminate or -aristate, gland-spurred teeth of nearly equal length, the dorsal one 2.7–4.8 mm long, nearly always longer than the tube; *petals* apparently whitish drying cream-colored, perhaps lilac when fresh (but not purple), the banner faintly rubescent, the banner sometimes sparsely gland-sprinkled, the keel sometimes minutely gland-tipped, the inner ones elevated ± 1.2–1.5 mm above the hypanthium rim; *banner* 5.3–7.5 mm long, the claw 3–4 mm, the deltate-cordate blade scarcely recurved, acute or subacute at apex, open at base, 2.6–3.5 mm long, ± as wide; *wings* 5.5–7.3 mm long, the claw 2.6–3.7 mm, the oblong-oblanceolate blade 3.2–4.2 mm long, 1.3–1.8 mm wide; *keel* 6.1–8.2 mm long, the claws 2.7–3.8 mm, the obliquely ovate blades 3.8–4.7 mm long, 2.5–3 mm wide; *androecium* 10-merous, 6.7–8 mm long, the longest filament free for 2.2–2.6 mm, the pallid, gland-tipped anthers 0.55–0.7 mm long; *pod* not seen, but the ovary closely resembling that of *D. pectinata*. — Collections: 3 (o).

Hillsides in pine or oak and pine forest, ± 1500 m, apparently rare, known only from the Sierra Madre between Mazatlán and Durango, either in Sinaloa or adjoining Durango, and from the coast range of extreme western Jalisco in the municipios of San Sebastián and Mascota. — Flowering January to March. — SINALOA or DURANGO: typus. JALISCO: San Sebastián trail to Mine La Sabala, *Mexia 1657* (BM, CAS, F, G, GH, MICH, NY, UC, US). Mascota to San Sebastián, *E. W. Nelson 4063* (US).

Dalea crassifolia (thick-leaved, of the plump leaflets) Hemsl., Diag. Pl. Nov. 40. 1878. — "NORTH MEXICO, Sierra Madre (*Seemann, 2190*)..." — Holotypus, K! isotypi, BM, US (fragm.)! — *Parosela crassifolia* (Hemsl.) Rose, Contrib. U. S. Nat. Herb. **12**: 272. 1909.

Because the plant body is glabrous up to the silky-plumose spikes and the leaflets of the main cauline leaves are very numerous (mostly 17–27 pairs), it has seemed most convenient for key purposes to contrast *D. crassifolia* with *D. polystachya*, easily distinguished by its rose-purple or vivid blue petals and looser spikes of relatively short-toothed calyces. Probably its closest relative, however, is *D. similis*, which has essentially the same inflorescence and individual flower together with leaves of like complexity but clad throughout with a mantle of soft, villous-tomentulose hairs. It might even be suspected that these two species, both discovered by Seemann somewhere in the Sierra Madre between Mazatlán and Durango, represent no more than marked pubescence-variants of one. However the leaves of *D. similis* are paripinnate, having lost the terminal leaflet, and the lowest pair of leaflets is perceptibly, even though only a little longer than all succeeding pairs, which diminish upward along the rachis. All leaves of *D. crassifolia* are of the imparipinnate type normal in *Dalea*, and the lowest pair is not larger than the rest. The less closely related *D. pulchella*, glabrous to the spikes like *D. crassifolia* but with the enlarged basal pair of leaflets found in *D. similis*, is sympatric with both these species on the Durango-Sinaloa boundary and with *D. crassifolia* in western Jalisco. Its denser head of vivid pink-purple flowers and small, almost round, often notched leaflets distantly arranged along the rachis distinguish it at a glance. Nothing is on record about the fresh color of the flower in *D. crassifolia*. The petals appear whitish or straw-colored in dried specimens, as do those of *D. similis*. Gentry found the inner petals of the latter lavender contrasting with a white banner, and it is likely that those of *D. crassifolia* are similar.

68. Dalea similis Hemsley
(Plate LXX)

Doubtless perennial (base of stem and root not seen), resembling *D. crassifolia* and *D. pectinata* in habit, with erect, virgate, leafy stems over 1 m tall branching distally into a several-headed, cymose panicle of spikes, densely and softly villous-tomentulose throughout with fine, sinuous, entangled together with some few straighter, spreading hairs up to 0.4–0.6 mm long, the stout, ribbed stems gray like the foliage, minutely glandular beneath the vesture, the leaflets equally pubescent both sides, inconspicuously punctate beneath; *leaf-spurs* 0.5–1.2 mm long; *stipules* narrowly linear-subulate, livid, fragile, 0.8–2.5 mm long; *intrapetiolular glands* 0 or minute; *post-petiolular glands* small, impressed, concealed by vesture; *main cauline leaves* 3–6 cm long, sessile, with stout, narrowly thick-margined rachis constricted at insertion of the leaflets, and 12–23 pairs of sessile, ovate to oblong-elliptic, subacute, shallowly boat-shaped leaflets (1) 1.5–5.5 mm long, the lowest pair substantially longer than the second pair, the rest very gradually diminishing upward along the rachis, the terminal one absent, represented by a subulate continuation of the rachis shorter than the ultimate pair, the leaves toward and within the inflorescence much shorter and simpler, with 6–12 pairs of smaller, otherwise similar leaflets; *peduncles* 1–2 cm long, but often appearing longer due to suppression of leaves at some upper nodes; *spikes* dense but hardly conelike, oblong-ovoid becoming shortly cylindroid, without petals ± 12 mm diam, the villous axis becoming ± 1.5–5.5 cm long; *bracts* deciduous, narrowly lance-acuminate, 4–6 mm long, the ovate, saccate-cymbiform body contracted gradually into a subulate, beaklike tail of ± equal length, the whole tomentulose dorsally, livid-castaneous and glabrous within; *calyx* 4–5.7 mm long, densely pilose externally with ascending, straight, spiral hairs up to 0.8–1.2 mm long, the tube measured to a dorsal sinus 2–2.5 mm long, the ventral sinus deeply recessed behind

the banner, the orifice oblique, the ribs slender, not prominent, the membranous flat intervals charged with 4–9 small, scattered (in narrower panels ± 1-seriate) glands, the triangular-acuminate, gland-spurred teeth somewhat unequal, the dorsal one longest, 2–3.2 mm long (0.5 mm shorter to 0.8 mm longer than tube), the ventral pair a little shorter but hardly wider; *petals* faintly bicolored, the banner opening white, in age purplish, its eye charged with a few scattered glands, the epistemonous petals pale lilac, perched 0.8–1.3 mm above hypanthium rim, glandless; *banner* 5.5–6 mm long, the claw 2.8–3 mm, the ovate-deltate, distally hooded blade open at base but with corners folded inward, 2.8–3.2 mm long, 3 mm wide; *wings* 5.2–6 mm long, the claw 2–2.5 mm, the oblong-obovate blade 3.3–3.7 mm long, 1.5–1.8 mm wide; *keel* 6.8–7.3 mm long, the claws 2.8–3.6 mm, the elliptic-obovate blades 3.6–4.3 mm long, 2.2–2.5 mm wide; *androecium* 6.5–7.5 mm long, the filaments free for up to 1.8–2.8 mm, the connective gland-tipped, the anthers yellow, 0.55–0.6 mm long; *pod* when young like that of *D. polystachya*, not seen ripe. — Collections: 4 (o).

Sunny hillsides in pine-oak forest, ± 1500–1950 m (5000–6500 ft), rare and local, known only from the w. slope of Sierra Madre Occidental in Sinaloa (perhaps immediately adjoining Durango). — Flowering January to March, possibly later. — *Material*: DURANGO (?): Cerro del Pinal, typus. SINALOA. Concordia: Durango-Mazatlán highway at El Batel, *Gentry 11,563* (MEXU, MICH, RENNER); 33 mi e. of Concordia, *Breedlove 1665-A* (MICH); 34 mi. e. of Villa Unión, *Ockendon 1406* (TEX).

Dalea similis (similar, apparently to *D. crassifolia*) Hemsley, Diag. Pl. Nov. 7. 1878. — "Cerro del Pinal, Durango, *Seemann*, 1533..." — Holotypus, collected December 1848, K (herb. Hook.)! isotypus, labelled "West Mexico, Hooker, 1849", K (herb. Benth.)! — *Parosela similis* (Hemsl.) Rose, Contrib. U. S. Nat. Herb. **12**: 273. 1909.

This rare and strikingly individual dalea may be recognized by a syndrome of dense villous vesture and paripinnate leaves composed of many (mostly 12–23 pairs) of small, essentially *sessile* leaflets diminishing upward along a stout rachis. The terminal leaflet is wanting, but is represented by a small, unjointed projection of the rachis shorter than the last pair of leaflets. The lowest pair of leaflets, situated directly next to the pulvinus, is substantially larger than the second pair, a feature unusual in *Dalea* but found also in the related and sympatric *D. pulchella*, a species otherwise very different in its glabrous, warty stems, small, round, glabrous leaflets, and bright purple flowers. In general organization and fine detail of the inflorescence, especially in the dorsally recessed calyx and pale lavender petals, *D. similis* resembles the also sympatric *D. crassifolia*, another rarely collected species discovered by Seemann on his round trip between Mazatlán and Ciudad Durango in the winter months of 1848–9. This is easily distinguished, however, by its glabrous stems and glabrous, regularly pinnate foliage. The similarly gray-villosulous *D. abietifolia*, a rare species known at present only from scattered stations in Jalisco and Michoacán, suggests *D. similis* in habit, but is usually a lower plant, up to about 6 dm (not over 1 m) tall; its leaflets are proportionately longer and narrower, the terminal one well developed, its calyx is little or not at all recessed behind the banner, and the petals (wings and keel) are vivid purple.

Breedlove describes the plant as annual, but an obligate monocarpic habit seems unlikely in the context of ser. *Pectinatae*. Possibly it is monopodial. Specimens collected by Ockendon at tne end of January are in young flower from drought-defoliated stems, but these are so tall that no herbarium specimen is likely to show the full stature or the root.

I have not identified Seemann's Cerro del Pinal, though it was doubtless on the west slope of Sierra Madre east of Mazatlán near the old trail across to Durango City.

69. Dalea virgata Lagasca
(Plate LXXII)

Robust suffruticose perennial herbs up to ± 1 m tall, the numerous virgate stems erect and ascending from an ultimately indurated base, effusely paniculate and only sparsely leafy distally, with spikes terminating all the branchlets, the stems below the middle striate, purplish, smooth, glabrous or obscurely puberulent, upward becoming thinly pilosulous or villosulous and at least sparsely verruculose, the young twigs and leaves puberulent to villosulous with short, curly or contorted hairs up to 0.1–0.4 mm long, the foliage green, the leaflets either glabrous or pubescent above, densely gland-speckled beneath; *leaf-spurs* 0.5–1 mm long; *stipules* linear-subulate or subsetiform, livid, becoming fragile and caducous, 0.5–4 mm long, glabrous, or minutely puberulent to thinly pilosulous; *intrapetiolular glands* 2, conic; *post-petiolular glands* prominent, mammiform or prickle-shaped; *main cauline leaves* 2.5–7 cm long, shortly petioled, with very narrowly margined, sparsely punctate rachis and 10–17 pairs of elliptic, bluntly gland-mucronate, dorsally carinate leaflets 4–10 mm long, either flat with elevated margins or shallowly cymbiform but not folded, the terminal leaflet sessile, usually a trifle shorter than the last pair, the leaves accompanying inflorescences smaller, with fewer (4–8 pairs of) shorter leaflets; *peduncles* 0–5.5 cm long; *spikes* dense but not conelike, ovoid becoming oblong-cylindroid, without petals ± 1 cm diam, the densely pilosulous axis becoming (0.5) 1–4 cm long; *bracts* deciduous, lance-acuminate or -caudate, boat-shaped, 3–5 mm long, livid and gross-glandular dorsally above the submembranous base, the lowest either glabrous or puberulent, the rest dorsally pilosulous at base or up to the middle, thence glabrate, all densely sericeous within; *calyx* 4.6–5.5 mm long, densely but shortly silky-pilosulous, the pallid, finally brownish tube ovoid, 2.6–3.3 mm long, faintly ribbed, the membranous intervals charged with small, scattered, transparent or yellowish glands, the triangular- to lance-acuminate teeth unequal, the dorsal one longest, 1.4–2.3 mm long, the rest shorter and broader, all minutely gland-spurred, the oblique orifice a little recessed behind the banner; *petals* lilac-purple or violet, the pale-eyed banner usually gland-tipped, the keel and wings elevated 1–2 mm above the hypanthium rim, the keel-blades united by their margins; *banner* 6.4–7.9 mm long, the claw 3–3.8 mm, the quadrately ovate-cordate blade 3.5–4.6 mm long, 3.6–5.2 mm wide; *wings* 6.2–7.9 mm long, the claw 2.2–2.9 mm, the oblong-elliptic or -oval blade 4.2–5.5 mm long, 1.5–2 mm wide; *keel* 8.3–11 mm long, the claws 3–4.5 mm, the broadly oval-obovate blades 5.7–7 mm long, 2.6–3.1 mm wide; *androecium* 10-merous, 8–9.8 mm long, the longest filament free for 2–2.8 mm, the anthers gland-tipped, 0.5–0.6 mm long; *ovary* thinly pilosulous and minutely glandular near apex, otherwise glabrous. — Collections: 9 (ii).

Open places on brushy hillsides in the oak-belt and ascending into thin pine-forest, 1950–2250 m (± 6500–7250 ft), local but forming colonies, known only from central Oaxaca (Sierra de San Felipe; Cordillera de Yavezía; Mixteca Alta). — Flowering October to February. — *Representative*: Oaxaca: Cordillera de Yavezía, *Galeotti 3153* (BR, W); Sierra de San Felipe, type-collections of *Parosela oaxacana* and *P. smithii, Ripley & Barneby 14,613* (NY), *Conzatti 4061* (MEXU); 22 mi s.-e. of Nochixtlán, *Ripley & Barneby 14,592* (CAS, F, GH, MEXU, MICH, NY, UC, US).

Dalea virgata Lag., Gen. & Sp. Nov. 23. 1816. — "Habitat in Imperio Mexicensi. In Hort. Reg. Matrit...." — No typus examined, but a cultivated specimen preserved at MA seen in form of *Field Negative 29,414*, F!

(?) *Dalea pyramidalis* Schlechtd., Linnaea **12**: 292. 1838. — "In terris Mexicanis (Hegewisch hb. Lehm. et Bueck)." — Holotypus, presumably at HAL (herb. Schlechtd.), not seen, but the detailed description suggests no other species. So interpreted by Mart. & Gal., Bull. Acad. Brux. **10**(2): 43. 1843.

Parosela oaxacana (of Oaxaca) Rose, Contrib. U. S. Nat. Herb. **10**: 104. 1910. — "Type ...collected by Dr. C. G. Pringle on the Sierra de San Felipe, Oaxaca, 2250 meters, October 10, 1894 (no. 4961)." — Holotypus, US! isotypi, GH, M, MEXU, NY, UC, W, Z! — *Dalea oaxacana* (Rose) Bullock, Kew Bull. **1939**: 197. 1939.

Parosela smithii (Charles Leonard Smith, 1866–) Rydb., N. Amer. Fl. **24**: 106. 1920. — "Type collected in Sierra de San Felipe, Oaxaca, November 19, 1894, *Charles L. Smith 343*..." — Holotypus, US! isotypi, F, NY, UC, and apparently, misnumbered *345*, MEXU!

Parosela conzattii (Cassiano Conzatti, 1862–1951) Rydb. N. Amer. Fl. **24**: 89. 1920. — "Type collected at Cerro San Antonio, Oaxaca, December 15, 1901, *Conzatti*..." — Holotypus, US! clastotypus (fragm), NY! — The specimen from Las Huertas, MEXU, labelled *Conzatti 4061*, is perhaps an isotypus!

At the height of its flowering season, in the sere months of late fall and early winter, *D. virgata* is among the handsomest shrubby daleas found in Mexico. The mature plant forms a sturdy bush about a meter high and through, formed of a multitude of virgate stems, at first simple and densely leafy, but branching distally into an ample, corymbose panicle of heads. In its small known range *D. virgata* is associated with two shrubby congeners, *D. versicolor* var. *versicolor* and *D. bicolor* var. *naviculifolia*. In both of these the leaflets are normally fewer, only exceptionally in excess of ten (as opposed to 10–17) pairs, and the flowers when young are distinctly bicolored, with banner at first white or yellowish in contrast to the purple keel. The calyx of var. *versicolor* has long (mostly 2.5–4, not 1.4–2.3 mm), plumose teeth; that of var. *naviculifolia* broadly ovate, minutely puberulent teeth less than 1 mm long. From *D. polystachya*, a related species not known to be sympatric but present in Sierra Madre del Sur not far distant, *D. virgata* differs (inter alia) by its larger flowers subtended by bracts silky (not glabrous) on the inner side.

The number of synonyms listed above suggests a highly variable species, but this is hardly so. The mature leaves vary from subglabrous to obviously pubescent, but the young foliage, at least high on the stems, is never wholly hairless. The calyx-teeth (especially the ventral pair) vary somewhat in length, but the dorsal one never, as far as now known, exceeds the tube. The stems, always charged with glands, might sometimes be described at tuberculate and sometimes not, the glands becoming, I suspect, more prominent as the stems age. These variations show no obvious correlation and do not affect materially the essentially uniform aspect of the plants. Rydberg referred specimens of *D. virgata* to three species of different sections in *Parosela*: *Lasiostachyae* (*P. smithii*, supposedly glabrous), *Tuberculatae* (*P. conzattii*), and *Versicolores* (*P. oaxacana*). Reassembled, the type-collections of these three segregates do illustrate a certain range of difference, but at the same time are closely similiar in habit, foliage, and detail of the flower.

During preliminary studies I have annotated and distributed all material of *D. virgata* as *D. oaxacana* (Rose) Bullock, the name under which I first learned to know the species. Here, with some misgiving, I take up the much earlier but poorly documented name *D. virgata*. Lagasca described *D. virgata* from plants grown in the Madrid Botanical Garden from seed known to be from Mexico, very likely sent home by Sessé or Maldonado. During my visit to the Madred herbarium I was unable to find any material so named, and as the protologue is too short and too generalized to provide a definite identification of the species, I had determined to discard it as an insoluble puzzle. Subsequently, however, I have seen the Field Museum photograph of an old specimen at MA which is labelled *D. virgata* and certainly represents the species here discussed. There is nothing in Lagasca's description which would exclude *D. oaxacana*, and it seems safe to assume that the Madrid

specimen, if not actually a typus, is authentic for the species grown there under Lagasca's name. The name *D. pyramidalis* Schlechtd. is also referred here with some doubt, although for different reasons. No typus has been seen, but the long and exceptionally detailed description fits *D. virgata* precisely and suggests no other known *Dalea*. Schlechtendahl knew *D. pyramidalis* only as Mexican, preserved without more exact locality-data in the herbaria of Bueck and Lehmann. It may be worth noting that *D. hegewischiana* Steud., originally described by Schlechtendahl from specimens of the same provenance, is found today in the vale of Oaxaca, flowering at the same season as *D. virgata*. I have found no reference in the literature to the botanical itinerary of Hegewisch in Mexico.

IVC (iv). Series Asperatae Barneby

Perennial herbs, the tough but slender, erect stems charged with livid, tack-shaped warts; *leaflets* of primary leaves 3–5 pairs, obovate, up to 14 mm long; *inflorescence* racemose, the bracts persistent, not clasping the buds; *calyx-teeth* triangular-deltate, not or scarcely longer than wide, much shorter than tube; *petals* bicolored, the ample banner creamy (rubescent) a little longer than detached keel, the epistemonous ones blue, high-perching and short-clawed. — Sp. 1, of local dispersal on dry limestone hills in e.-centr. Puebla and n.-centr. Oaxaca.

Dalea subgen. **Parosela** sect. **Parosela** ser. **Asperatae** Barneby, ser. nov., ab affinibus (praesertim ser. *Paroselae* pertinentibus) caule glandulis capitatis nigris dense obsito necnon inflorescentia laxiuscule racemosa (nec spicata) absimiles. — Sp. unica: **D. caeciliae** Harms.

70. Dalea caeciliae Harms
(Plate LXXIII)

Herbaceous or in age weakly suffrutescent, 3.5–7.5 dm tall, the (1) 3–several stems erect and ascending from a tough yellow root, simple or few-branched distally, charged throughout with elevated, tack-shaped verrucae up to 0.15–0.2 mm tall, stramineous or lurid, faintly striate, the foliage (at least the leaf-rachis and margins of leaflets) pilosulous with fine ascending hairs up to 0.3–1 mm long, the leaflets bicolored, yellowish-green and either glabrous or pilosulous above, beneath glabrous or more thinly pilosulous and punctate, but some axillary leaf-spurs arising late in the season with leaflets densely pilosulous both sides and silvery-gray; *leaf-spurs* 0.5–1.4 mm long; *stipules* subulate to narrowly lanceolate, 1.5–3.5 mm long, glabrous or ciliolate, pubescent within, glabrous and glandular dorsally; *intrapetiolular glands* small; *post-petiolular glands* rounded, not very prominent; *leaves* petioled, the petiole and rachis densely verruculose, the main cauline ones 4–8 cm long with 3–5 distant pairs of obovate, obtuse to truncate but often minutely apiculate or gland-mucronate, flat or loosely folded leaflets 6–14 mm long, the terminal leaflet stalked beyond the last pair, the upper leaves and spur-leaves shorter, with 2–3 pairs of similar but smaller leaflets; *peduncles* mostly leaf-opposed, (1.5) 2.5–7 (9) cm long; *racemes* loose and narrow, the flowers 2-ranked when pressed, without petals 7–9 mm diam, the pilosulous axis finally 3–9 (11) cm long; *bracts* persistent at least until fall of the fruit, loosely spreading-incurved, narrowly lance-elliptic, boat-shaped, carinate dorsally, 3–5.5 (6) mm long, membranous-margined below middle, dorsally glabrous to thinly

pilosulous, glandular, within pilosulous; *calyx* 3.8–4.5 mm long, the tube 2.4–3 mm long, the ventral sinus somewhat recessed and the orifice hence oblique, either glabrate or thinly pilosulous externally, the ribs slender, livid-nigrescent, the broad, plane, glossily membranous intervals charged with 1–2 rows of ± 5–7 small golden glands, the broadly ovate- or deltate-triangular, gland-tipped teeth unequal, the dorsal one 1.2–1.9 mm long, the ventral pair shorter and broader; *petals* bicolored, the banner opening greenish-yellow or creamy, sometimes with pink-tipped basal lobes, fading dull purplish, the epistemonous ones rich blue beyond the paler base, perched 2.7–5 mm above hypanthium, the banner often charged with a few scattered glands on the blade and, like the keel, with a small subapical gland; *banner* 5.6–7.3 mm long, the claw 2.5–3.4 mm, the blade deltate-obcordate, openly emarginate, slightly callous but open at base, 3.4–4 mm long, 3.8–4.8 mm wide, recurved at about 40° from claw; *wings* 4.2–5.7 mm long, the claw 0.5–0.8 mm, the ovate blade 3.9–5.2 mm long, 2.3–2.9 mm wide; *keel* 5.3–6.9 mm long, the claws 1–1.7 mm, the broadly obliquely ovate blades 4.6–5.7 mm long, 3.4–4.4 mm wide; *androecium* 9–10-merous, 6.7–11 mm long, the longer filaments free for 2–3.2 mm, the connective gland-tipped, the anthers 0.6–0.85 mm long; *pod* obovate in profile, 2.8–3.4 mm long, the style-base latero-terminal, the valves hyaline and glabrous in lower ½, thence papery, finely reticulate, distally thinly pilosulous and charged with a few tiny scattered glands, the ventral suture filiform; *seed* pale brown, 2–2.4 mm long; 2n = 14 (Mosquin). — Collections: 5 (ii).

Arid rocky limestone hills, 1880–2200 m (± 5600–7350 ft), locally abundant but known from only two small areas: on and near the Atoyac-Papaloapan divide in e.-centr. Puebla (mpos. Acatzingo and Santiago Miahuatlán); headwaters of Río Mixteco in n.-centr. Oaxaca (mpo. Teposcolula). — Flowering June to December, perhaps also in spring. — *Material*: PUEBLA. Acatzingo: near Acatzingo, *Arsène & Amable in July 1907* (BR, s. n., US, numbered *2033, 2037*); ibid. *in Dec 1909, Fr. Nicolás* s. n. (F, L) and distrib. *Arsène 5071* (US). Santiago Miahuatlán: Azumbilla, *Ripley & Barneby 14,736* (CAS, GH, MEXU, MICH, NY, US). OAXACA. Teposcolula: San Juan Teposcolula, *Ripley & Barneby 14,687* (ARIZ, CAS, DAO, F, GH, IA, K, MEXU, MICH, UC, US, approximate topotypi). Mexico, sine loc., *Karwinski 5754* (M).

Dalea caeciliae (Caecilie Sachs, wife and collaborator of ethnologist Georg Eduard Seler) Harms, Verh. Bot. Ver. Brandenb. **65**: 87. 1923 ("*Caeciliae*"). — "Habitat in Mexico, in prov. Oaxaca, in distr. Teposcolula, in Cerro del Pueblo viejo: Seler n. 1410." — Holotypus, formerly B, destroyed; isotypus, collected 26 September, 1905, by C. & E. Seler, US!

The very distinct *D. caeciliae* may be recognized instantly by the tack-shaped warts densely clothing the rather tall, wiry stems, combined with a narrow spiciform raceme of blue flowers, each standing on a short footstalk in the axil of a long-persistent bract. The structure of calyx and petals is almost that of presumably related species of ser. *Parosela,* but the banner has a proportionately much shorter claw.

This species seems to have been collected first by Karwinski in 1827, but no exact locality was recorded and the specimen lay until recently unnamed in the Munich herbarium. Because each of the two localities known in Puebla lies close to one of the principal colonial highways leading from Veracruz to the central plateau, it might easily have been among the unidentified daleas which, collected by the Botanical Mission to Nueva España in late XVIII century, reached the Lambert herbarium through Pavón and were there described by George Don. But I have failed to link it with any described name. The

first specimens known to me were seen to be distinct from anything described by Rydberg, and some collections from Acatzingo collected by Arsène and collaborators were accordingly annotated with an unpublished name ("*fraterna*"). Later on I not only collected topotypes of *D. caeciliae* but also found the cited isotypus in the National Herbarium, and was thereby enabled to establish the hitherto obscure identity of the species.

IVC (v). Series Parosela

Annual and perennial herbs, some softly frutescent in age but not genuinely shrubby, usually pilose with at least a few weak spiral hairs, these sometimes confined to leaf-rachis; *leaflets* 2–6 pairs, in the common species expanded and some well over 6 mm long; *spikes* loose or moderately dense, never conelike; *bracts* persistent, often conspicuous; *calyx* hyaline except for filiform, usually livid ribs, the intercostal panels charged with a single series of small glands, the deltate-triangular teeth often wider than long, much shorter than tube; *petals* ± bicolored, the ample, long-clawed banner opening whitish, soon rubescent, much longer than detached keel, the epistemonous petals dull violet or bronze-purple, perched high on androecium, short-clawed. — Spp. 3, of s.-centr. Mexico s.-ward from San Luis Potosí and Jalisco, 1 extending s. into Honduras.

Dalea subgen. **Parosela** sect. **Parosela** ser. **Parosela**. *Dalea* subgen. *Parosela* sens. str., q. v. supra. — Sp. typica: *Parosela mutabilis* (Cav.) Cav. = (syn. tax.) **Dalea obovatifolia** Ort.

Parosela subgen. *Euparosela* XVII. *Unciferae* Rydb., N. Amer. Fl. **24**: 81. 1920. — Sp. lectotypica: *P. uncifera* (Schlechtd. & Cham.) Rose = **Dalea obovatifolia** var. **uncifera** (Schlechtd. & Cham.) Barneby.

A highly specialized, sharply characterized series, with the addition of *D. mixteca* and *D. insignis* exactly equivalent to Rydberg's *Unciferae*. The flower is remarkable for the short-toothed, membranous calyx, and especially for the long-stalked banner which stands opposed to a much shorter, short-clawed keel perched usually well above middle of the far extruded androecium. The coloring of the petals is unusual in the genus, the purples of the epistemonous ones ranging through tones of dull purplish and slatey blues to intense, dark wine-purple, sensibly different from the gamut of rose- and phlox-purples dominant in sect. *Parosela*. Other notable features of ser. *Parosela* are the relatively few, usually expanded leaflets, a characteristic (sometimes rudimentary) vesture of long weak hairs, and a tendency, reaching unparalleled and startling extremes in *D. insignis*, to enlargement of the stipules and the persistent bracts. Stipules and vesture of similar type recur in ser. *Reclinatae*, especially in *D. reclinata* itself, which differs, however, in its relatively long-toothed calyx and due to conditions imposed by a linear arrangement, appears in this account at much greater distance below than is ideally desirable.

Key to the Species of Ser. *Parosela*

1. Body of the interfloral bracts in profile less than 5 mm long and less than 3 wide, clasping base of calyx but not concealing it wholly; *calyx* ciliolate around orifice, often but not always pubescent externally.
   2. Flowers variable in size, but the keel-blades not less than 2.9 mm long; *androecium* fully expanded (5) 5.5–9.5 mm long; *spikes* relatively compact, the calyces subcontiguous, the axis densely pilose-pilosulous; widespread.
      71. *D. obovatifolia.*

2. Flowers very small, the keel-blades 1.8–2 mm long; *androecium* ± 3.5 mm long; *spikes* lax, the flowers well-separated, when pressed 2-ranked, the axis glabrous; local in w.-centr. Oaxaca. 72. *D. mixteca.*

1. Body of bracts in profile 6–8 mm long, 3.5–5.5 mm wide, membranous and veiny, completely enveloping and twice as long as the small, glabrous calyx; local in Puebla (? conterminous Veracruz) and centr. Oaxaca. 73. *D. insignis.*

71. DALEA OBOVATIFOLIA Ortega
(Plate LXXIV)

Herbs, variable in stature and duration of the (yellow) root, when monocarpic either slender and obviously so or robust and coarse, becoming softly woody in age, when perennial often diffuse or prostrate, the stems when adult becoming 1.5–12 dm long, usually purplish and thinly orange-glandular upward, the whole variably pilose with weak, spreading-ascending, spiral, when dry rufescent hairs, the stems and leaflets sometimes glabrous but the leaf-rachis and top of peduncles then usually pubescent, exceptionally glabrous up to the spike, the foliage bicolored, the thin-textured leaflets deep green and always glabrous above, beneath pallid, punctate and if glabrate then usually ciliate; *leaf-spurs* (0.5) 1–3 mm long; *stipules* narrowly lanceolate to linear-caudate, (1) 2.5–12 mm long, the body membranous-margined, contracted into a usually linear, gland-tipped tail; *intrapetiolular glands* conic, usually minute; *post-petiolular glands* small, sometimes immersed; *leaves* shortly petioled, 1.5–6 (7) cm long, with narrowly margined rachis and (2) 3–5 (6) pairs of obovate to broadly oblanceolate, obtuse, truncate-emarginate, or short-acuminate, gland-apiculate, flat or loosely folded leaflets (2) 3–22 (25) mm long; *peduncles* (1) 1.5–8 cm long; *spikes* moderately dense, ovoid or conic early becoming oblong-cylindroid, without petals or protruding bract-tails 7–11 mm diam, the pilosulous axis finally (1) 2–11 cm long; *bracts* persistent, differentiated into a broadly ovate, elliptic, or oblanceolate boat-shaped body 2–4 (5) mm long, pallid-membranous in lower ½, livid and orange-glandular along and near its dorsal keel, and a spreading, linear or subulate, often apically hooked, livid, thinly pilosulous tail (0.5) 0.8–6 mm long; *calyx* 2.4–5.4 mm long, the deeply campanulate tube 1.8– 4.3 mm long, either thinly pilose or glabrous externally, the ribs filiform, livid, the broad, lustrously hyaline intervals either eglandular or with 1 row of small orange blister-glands, the ciliolate orifice ± oblique, the teeth low-deltate to broadly triangular, 0.5–1.3 mm long, mucronulate; *petals* bicolored, the banner whitish or greenish-creamy on opening, fading purplish, the wings pale at base, distally like the whole keel dull violet commonly turning bronze-blue or -purple in age, the epistemonous ones perched near middle of androecium; *banner* (4) 4.5–11.4 mm long, the claw (2.2) 3–6.6 mm, the ovate to deltate-cordate blade 2.3–4.6 mm long, 2.8–4.6 mm wide; *wings* 3.5–6 mm long, the claw 0.2–2.1 mm, the oblong or lance-oblong, short-auriculate blade 2.8–6 mm long, 1.7–2.6 mm wide; *keel* (3.7) 4.4–8.4 mm long, the claws 0.8–2.8 mm, the broadly obliquely obovate blades (2.9) 3–6.3 mm long, 1.7–4.5 mm wide; *androecium* (9) 10-merous, 5–13 mm long, cleft distally into a tassel about ¼ its full length; *pod* in profile obliquely obovate or subdeltate, (1.8) 2–2.7 (3) mm long, the sutures filiform, the slender prow often livid-tinged, the valves hyaline in the lower half, thence thinly papery, pilosulous at least along the prow and style-base, sparsely gland-sprinkled; *seed* brownish-olivaceous, smooth, lustrous, 1.6–2.1 mm long; x = 7.

As defined in the description this is a polymorphic species, adapted to a variety of environmental niches and phenetically so much modified thereby that it can hardly be spoken of in general terms. However it is ordinarily recognized by its few (mostly 3–5) pairs of expanded leaflets, shortly broad-toothed calyx of characteristic hyaline texture divided into broad panels by filiform livid ribs, and a peculiar lurid purplish coloration of the petals, impossible to render in precise language. My concept of *D. obovatifolia* developed in field and herbarium studies has become coextensive with Rydberg's species-group *Unciferae*, always excepting the related but distinct *D. insignis* abruptly marked off by its immense sheathing bracts. Seen in modern perspective, it is a complex of forms within which several of Rydberg's taxa represent no more than particular individual combinations of characters involving duration of the root, pubescence, and form of bracts.

Life-form in *D. obovatifolia* seems remarkably plastic. The plants appear as slender monocephalous annuals, as rank monopodial annuals with repeatedly branching crown, and as lowly, diffuse or prostrate perennial herbs. The perennial habit is prevalent around the south edge of the Mexican plateau, in cool xeric climate. In the more benign environment of the oak-pine belt the annual habit prevails, and here, in late winter, the older plants may develop a softly woody base, sometimes described as shrubby but never truly so. Pubescence in *D. obovatifolia* is of the same basic type everywhere, but varies much in density and dispersal over the plant body. At one extreme lies a plant glabrous or nearly so up to the base of the flower-spikes; at the other a plant pilosulous everywhere but on the upper surface of the leaflets. Within the inflorescence there is much variation in size of the flower parts, and the calyx, whether larger or smaller, may be either glabrous or pilose externally. The nearest, yet imperfect approach to correlation of variables that at the same time coincides with patterns of dispersal is found in a syndrome of diffuse, perennial growth-form, larger flower, glabrate foliage, and pubescent calyx-tube, corresponding more or less with *Parosela mutabilis* + *P. bicolor* sensu Rydberg (but not *Dalea bicolor* Willd.) opposed to a syndrome of annual, usually erect (but either rank or thrifty) habit, smaller flower, more pubescent foliage and glabrous calyx-tube, corresponding with *P. uncifera*. There remain, however an inconveniently large number of specimens in which one of the supposed differential characters occurs in the wrong setting. Thus the holotype and only known example of *P. caudata* Rydb. is a slender, small-flowered annual with pubescent calyx-tube; that of *P. attenuata* Rydb. is essentially like *P. uncifera* but large-flowered, and probably perennial. Duration of the root has little taxonomic significance in the complex, and is in any case open to conflicting interpretations, the potentially perennial type flowering at the close of its first season, as though monocarpic, and the monocarpic types persisting in favorable sites until a second year. Likewise features of pubescence and length of interfloral bracts, heavily emphasized by Rydberg, do not help greatly in the definition of subspecific taxa, even though they may correspond with fairly well-marked variational trends. It is proposed therefore to recognize within *D. obovatifolia* only two varieties distinguished primarily by flower-size, the subordinate characters being only imperfectly correlated but often in practice useful.

The nomenclature of *D. obovatifolia* has presented a difficult problem due to the fact that Gómez Ortega and Cavanilles almost simultaneously described under different names what is believed to be the same plant, which flowered in the Madrid Botanic Garden in late summer of 1797. The description of *Psoralea mutabilis* Cav., accompanied by a fine illustration and backed up by herbarium vouchers still extant (MA) is so greatly superior to that of Ortega, whose specimens, if any were made, have not survived, that it has been preferred by all authors of note, including Willdenow when he transferred *Ps. mutabilis* to *Dalea*, and Rydberg (1920, p. 83) in his revision of *Parosela*. Already as early as 1802, when Cavanilles shifted his *Ps. mutabilis* to *Parosela*, and again in his *Elenchus Horti Matritensis* in 1803, the name *D. obovatifolia* Ort. is cited as a synonym. According to Stafleu (1967), the latter can nevertheless claim a priority of several months, having been

published within (certainly late within) the year 1797, whereas the signature of Cavanilles's Icones containing *Ps. mutabilis* did not appear until May 1798. During all my preliminary studies I have used in annotations the traditionally accepted *D. mutabilis* and an unpublished trinomial involving var. *uncifera*. These now, it seems clear, must give way to *D. obovatifolia*.

There remains, however, the awkward uncertainty as to the exact identity of Ortega's plant, no longer verifiable except through the short description, which might apply to either variety of *D. obovatifolia* as defined herein. It is only on the word of Cavanilles that *Ps. mutabilis* and *D. obovatifolia* are presumed to be the same. Both entities are represented in the collections of Sessé & Mociño (var. *obovatifolia*: *S. & M. Herb. 2678bis*; var. *uncifera*: *S. & M. Herb. 2678*, and the holotypus of *D. coronilla*, cited infra), and both *could* have been growing in the Madrid Garden. It is troubling that Sessé's material of var. *uncifera* was distributed by Pavón under the name "*Dalea obovata*," an epithet not identical with that used by Ortega, but suggestively similar. In order to settle the question and put an end to speculation as to the exact nature of *D. obovatifolia*, it seems justifiable to designate as neotypus the same specimens in herb. Cavanilles. that serve as holotypus of *Ps. mutabilis*, automatically reducing the problem to one of pure nomenclature, already solved by Stafleu.

Key to the Varieties of *Dalea obovatifolia*

1. Calyx (3.5) 3.7–5.4 mm long, its tube 2.8–4.3 mm, if rarely shorter then pubescent externally from base upward; *banner* mostly 8–11.5 mm long; *keel-blades* 5–8.4 mm long; pronounced xerophytes, mostly of the margins of the Mexican plateau, Puebla to n.-e. Jalisco and San Luis Potosí, also in central highland Oaxaca. 71a. var. *obovatifolia*.
1. Calyx 2.4–3.5 (3.8) mm long, its tube 1.8–2.8 mm long, if slightly longer then glabrous except at mouth; *banner* (4) 4.5–7.7 mm long; *keel-blades* (2.9) 3–4.9 mm long; generally more mesophytic, descending into *tierra caliente*, along Cordillera Neovolcánica from Veracruz to Michoacán, and along Sierra Madre del Sur from Guerrero to Oaxaca, also locally in Guatemala and Honduras. 71b. var. *uncifera*.

71a. DALEA OBOVATIFOLIA Ortega var. OBOVATIFOLIA
(Plate LXXIV)

Perennial (sometimes precociously flowering) and herbaceous, the stems commonly decumbent to weakly assurgent, (1) 2.5–4.5 (6) dm long; *pubescence* variable, but stems distally and leaf-rachis normally ± pilose, the leaflets sometimes ciliate, the stems and leaflets sometimes glabrous; *leaf-spurs* mostly 0.5–2.5 mm, *stipules* (2) 3.5–6 mm long; *spikes* (1) 2.5–8 (11) cm long; *flowers* usually large (as given in key), subtended commonly by short-tailed bracts; $2n = 14$, 7_{II} (Mosquin). — Collections: 59 (iv).

Plains and open hillsides, usually in depauperate (secondary) grassland, but entering, perhaps originating in, the oak-pine belt, locally plentiful on eroded and gullied land, 1350–2650 m (4500–8500 ft), common in the Valley of Mexico, Distrito Federal and adjoining México and Hidalgo, probably adjoining e. Michoacán, n.-e. in Hidalgo to Jacala, s.-e. into highland Puebla; apparently disjunct in s. San Luis Potosí (Sa. de Alvarez) and adjoining n.-e. Jalisco (Ojuelos); centr. Oaxaca. Not recorded from

Guanajuato, Querétaro, or Tlaxcala, but to be expected. — *Representative*: JALISCO: *McVaugh 16,907* (MICH). SAN LUIS POTOSÍ: *Rzedowski 5267* (ENCB). HIDALGO: *Chase 7119* (ARIZ, F, NY, transitional in some respects to var. *uncifera*); *Rzedowski 23,335* (ENCB). MÉXICO (incl. D.F.): *Pringle 3181* (BR, F, M, NY, UC, US, W); *Ripley & Barneby 14,523* (DAO, NY); *Matuda 21,059* (MEXU, NY). PUEBLA: *Balls 4506* (K, UC, US); *Rose & Hay 5661* (NY, US); *Mosquin et al. 6657* (NY). OAXACA: *Andrieux 447* (G, M, W); *Galeotti 3241* (BR, W); *Ripley & Barneby 14,606* (NY, US), *14,677* (DAO, NY).

Dalea obovatifolia (with obovate leaflets) Ortega, Decades 32. 1797. — "Habitat in insula Cuba. Floret in mense Augusto et Septembri in Reg. Horto Matritensi e seminibus missis per D. Sessé." — No typus found at MA; neotypus: "Ex regno Mexicano culta in hort. Mat. anno 1797", MA (herb. Cav.)!

Psoralea mutabilis (changeable, of the petal-color) Cav., Icones 4^2: 65, Pl. 394. 1798 (maio 14 — cf. Taxon **10**: 78. 1961). — "Habitat in insula Cuba, et in Regno mexicano... colitur in Regio horto Matritensi, ubi floruit Iulio et Augusto 1797." — Holotypus: "Ex regno Mexicano culta in hort. Mat. anno 1797", MA (herb. Cav.) = neotypus of preceding! isotypus, BM! — *Dalea mutabilis* (Cav.) Willd., Sp. Pl. **3**: 1339. 1801. *Parosela mutabilis* (Cav.) Cav., Descr. Pl. 186. 1802.

Parosela attenuata (gradually drawn out, of the bracts) Rydb., N. Amer. Fl. **24**: 82. 1920. — "Type collected in Sierra de San Felipe, Oaxaca, October 26, 1894, *Charles E. Smith 547...*" — Holotypus, NY! isotypi, F, US! — *Dalea attenuata* (Rydb.) Cowan, Brittonia **8**: 60. 1954.

Parosela bicolor sensu Rydb., N. Amer. Fl. **24**: 83. 1920. — Non *Dalea bicolor* Willd.

As seen in and near the Valley of Mexico, var. *obovatifolia* takes the form of a diffuse perennial herb with several stems radiating from the root-crown and bearing in late summer one or more oblong spikes of relatively large hyaline calyces. Pubescence is variable in density, the more and less hairy phases corresponding with Rydberg's *Parosela bicolor* and *P. mutabilis*. In central Oaxaca var. *obovatifolia* occurs not only in secondary (often heavily eroded) grassland but also in openings of sunny oakwoods, the stems there becoming more erect. This last phase, which suggests a large-flowered var. *uncifera*, was segregated by Rydberg as *P. attenuata*, but hardly deserves taxonomic notice.

First grown in Europe at the Madrid Botanical Garden, *D. obovatifolia* passed into rather wide cultivation in the stoves of Old World gardens, remaining in favor for about fifty years, and then apparently dying out. Bonpland had it at Malmaison (P) in 1813, where it was painted by Redouté. In 1823 Hooker figured a plant in *Exotic Flora* (vol. **1**, t. 43) that had grown under glass at Glasgow, and in the following year it appeared in Curtis's Botanical Magazine (t. 2486), where the origin of the model, grown at Chelsea, is said to be C. F. Otto, of the Berlin Botanical Garden. Hooker mistakenly called his plant *D. bicolor*, and Sims (in Curtis) followed the synonymy, but adopted the older name, *D. mutabilis*. It is under the last name that Loudon figured a small branchlet in one of her nosegays (Ladies' Fl.-Gard. Ornam. Perenn. **1**: t. 35) in 1843.

71b. DALEA OBOVATIFOLIA Ortega var. UNCIFERA (Schlechtendahl & Chamisso) Barneby

(Plate LXXIV)

Monocarpic but sometimes of long duration, then becoming softly woody at base, variable in stature, flowering when (1) 1.5–12 dm tall, monocephalous only when depauperate, usually branched either from near base or paniculately above middle,

often both; *pubescence* variable, but the young stems and leaf-rachis commonly pilose, sometimes densely so, the leaflets glabrous above but often ciliate; *leaf-spurs* mostly 1.8–3 mm long, stipules 2.5–11 mm long; *spikes* mostly 2–6 cm long; *flowers* relatively small (as given in key), subtended by relatively long-tailed bracts; n = 7_{II} (Spellenberg, 1973). — Collections: 52 (viii).

Oak-pine woodland and open pine-forest, descending into the thorn-scrub, becoming gregarious and locally abundant on roadside banks and disturbed places, (750) 1050–2510 m (2500–8400 ft), along Cordillera Neo-volcánica from Veracruz to Michoacán (w. to Tancítaro; to be expected in adjoining Jalisco), in parts of s. Mexico sympatric with var. *obovatifolia* but found usually in more mesic microhabitats; s. interruptedly to centr. Oaxaca (again near var. *obovatifolia*), highland Guatemala (Alta Verapaz, Jalapa, and Huehuetenango) and Honduras (Morazán). — Flowering August to December, sometimes on into late winter or early spring. — *Representative*: MEXICO. MICHOACÁN: *Hinton 15,463* (ARIZ, NY, TEX); *Pringle 4273* (BR, F, M, MEXU, NY, UC, W, Z); *Ripley & Barneby 14,084* (CAS, NY, MEXU). MÉXICO (incl. D.F.): *Hinton 5317* (ARIZ, F, MEXU, NY, Z); *Pringle 8714* (F, M, MEXU, NY, W, Z); *Bourgeau* 1057 (BR, F, M, NY, P). PUEBLA: *Arsène 1785* (BR, L, p. p., NY); *Ripley & Barneby 14,746* (NY). VERACRUZ: *Matuda 1224* (F, MEXU, US); *Ripley & Barneby 14,739* (CAS, NY). MORELOS: *Gentry et al. 19,591* (RENNER, US); *Ripley & Barneby 14,536* (NY). GUERRERO: *Mexia 9011* (ARIZ, F, NY, P, NY). OAXACA: *Ripley & Barneby 14,677a* (NY). GUATEMALA. ALTA VERAPAZ: *Steyermark 43,887* (F). HUEHUETENANGO: *Molina 21,418* (NY). JALAPA: *Standley 77,275, 77,280* (F). HONDURAS. MORAZÁN: *Molina 1263* (F, US), *1447* (US); *Standley 13,281, 14,144* (F).

Dalea obovatifolia Ort. var. **uncifera** (Schlechtd. & Cham.) Barneby, Phytologia **26**: 1. 1973, based on *Dalea uncifera* (bearing hooks, of the bract-tails) Schlechtd. & Cham., Linnaea **5**: 580. 1830. — Collected by Schiede & Deppe, the locality not mentioned in protologue but provided by Schlechtendahl, Linnaea **12**: 290. 1838. — "In agris prope Jalacingo reg. temp. (Schiede)..." — Holotypus not examined; isotypi, labelled "in agris pr. Talacingo [near Puebla-Veracruz line in lat ± 19° 45′], dec. 28″, OXF, and (numbered *276*) W! — *Parosela uncifera* (Schlechtd. & Cham.) Rose, Bot. Gaz. **40**: 144. 1905.

Dalea coronilla (crown-vetch, the foliage similar) G. Don, Gen. Hist. Dichl. Pl. **2**: 226. 1832. — "Native of Mexico...(v. s. in herb. Lamb.)." — Presumed holotypus, labelled by Pavón "Dalea sp. nov. de Mexico" with epithet *coronilla* added in an old hand, probably Don's, OXF! Spms in herb. Sessé & Mociño (*No. 2678*), F, MA, and at P, labelled "*D. obovata*. Nueva España. Herb. Pavón 1827" and "*Dalea Pinata*. Mex. M. Sessé", are perhaps isotypi.

Parosela caudata (tailed, of the bracts) Rydb., N. Amer. Fl. **24**: 82. 1920. — "Type collected in Mexico, in 1853, *Fred. Müller 844*..." — Holotypus, NY!

Mexia saw this dalea browsed by cattle in Guerrero (near Petlacala). Schlechtendahl recorded *D. uncifera* from "Grande" (= Atotonilco, near Pachuca, Hidalgo), collected by Ehrenberg. I have not seen corresponding specimens, but the extension northeast along the Gulf slope from central Veracruz seems not unlikely.

72. DALEA MIXTECA Barneby

(Plate LXXV)

Slender wiry annuals from a yellow root, the primary axis erect but early inhibited, giving rise near base to several prostrately radiating, simple or irregularly few-

branched stems up to (0.3) 1.5–4 dm long, these all smooth or remotely minutely glandular, thinly pilosulous with scattered weak sinuous ± spreading hairs up to 0.3–0.7 mm long, the foliage green or purplish, the leaflets glabrous both sides, ciliolate, smooth above, punctate beneath; *leaf-spurs* 0.5–1.2 mm long; *stipules* linear-subulate, ciliolate, 0.7–2.7 mm long; *intrapetiolular glands* minute; *post-petiolular glands* small but emergent; *leaves* mostly deciduous by late anthesis (hence little known), 1–1.5 cm long, shortly petioled, with margined rachis and (1) 2–3 (4) pairs of obovate ot obovate-cuneate, mostly emarginate, flat or weakly folded leaflets, the terminal one (usually elevated beyond the last pair) largest, up to 2.5–5.5 mm long; *peduncles* 0.5–3 cm long, the first of each stem appearing leaf-opposed, the rest terminal to branchlets; *spikes* loosely (5) 8–30 (35)-flowered, the flowers 2-ranked when pressed, not contiguous, the glabrous, flexuous axis becoming (0.5) 1–3 (3.5) cm long; *bracts* persistent, glabrous within and without, 2.4–4.2 mm long, the obovate boat-shaped body 2.2–3.4 mm long, embracing the calyx and in profile 1–1.4 mm wide, thinly herbaceous distally, scarious-margined, gland-sprinkled dorsally, abruptly contracted into a firm subulate involute tail 0.3–1 mm long; *calyx* 2.5 mm long, glabrous except for the silvery-ciliolate orifice, the tube 1.7–2 mm long, its ribs filiform, livid, the intervals scarious lustrous charged with 1 row of 3–4 minute fuscous glands, the broadly low-deltate teeth slightly unequal, the dorsal one longest and a little narrower than the rest, 0.5–0.8 mm long; *petals* at first bicolored, the banner greenish-white but early rubescent, the epistemonous petals dull wine-purple, perched 1.6–2.2 mm above hypanthium, all eglandular or the keel minutely gland-tipped; *banner* ± 3 mm long, the claw 1.6–1.7 mm, the deltate-cordate subacute hooded blade 1.5–2.7 mm long, 1.6–2.1 mm wide; *wings* 1.6 mm, the claw 0.3 mm, the oblong-elliptic blade 1.5 mm long, 0.8 mm wide; *keel* 1.8–2.3 mm long, the claws 0.4 mm, the blades 1.6–2 mm long, 1.2–1.6 mm wide; *androecium* 10-merous, 3.2–3.6 mm long, the longer filaments livid distally, free for 0.6–0.8 mm, the connective minutely gland-tipped, the anthers 0.3 mm long; *pod* triangular in profile, 2–2.4 mm long, the style at one corner, the glabrous valves hyaline in lower ⅓, thence papery, purple or livid, minutely gland-sprinkled; *seed* olivaceous, 1.6–1.8 mm long; 2n = 14 (Mosquin). — Collections: 1 (i).

Dry rocky hillsides, on limestone, 1980 m (6600 ft), known only from the headwaters of Río Mixteco, in mpo Teposcolula, Oaxaca. — Flowering October–November.

Dalea mixteca (of the Mixtec Indians) Barneby, sp. nov., *D. obovatifoliae* Ort. praesertim var. *unciferae* (S. & C.) Barneby affinis, floribus minimis secus axin glabrum laxe spicatis, carinae laminis 1.6–2 (nec ± 3–5) mm longis, necnon androecio abbreviato ± 3.5 (nec 5.5 et ultra) mm longo absimilis. — OAXACA: arid limestone hills, associated with *D. caeciliae* Harms, San Juan Teposcolula, nov 6, 1966, *Ripley & Barneby 14,688*. — Holotypus, NY; isotypi, CAS, DAO, GH, K, MICH, US.

This is an inconspicuous little dalea, with wiry stems pressed to the ground, drought-deciduous foliage, and tiny flowers, the inner petals dark plum-purple, almost black. The species is related to *D. obovatifolia*, especially its relatively small-flowered, monocarpic var. *uncifera*, and perhaps derived from it. Calyces of *D. mixteca* and var. *uncifera* are essentially similar, but the latter differs in its longer petals and androecium, its spike pilosulous between flowers that stand close together, separated only by long-tailed bracts, in several vertical ranks.

73. DALEA INSIGNIS Hemsley
(Plate LXXIII)

Coarse monocarpic herbs, 2.5–8 dm tall, either erect, monopodial and branched distally or (more often) branching from near base with 2–several lateral incurved-ascending major axes, the root bright yellow, the stems eglandular, purplish or greenish-stramineous, the whole glabrous except for a few weak spreading hairs on leaf-rachis and petiolules, but the raceme-axis and tail of bracts pilosulous; *stipules* lanceolate to broadly ovate-acuminate and ± cordate at base, (3) 5–11 mm long, foliaceous becoming papery, palmately several-nerved, the nerves livid, enclosing pallid intervals, these charged with many small honey-colored glands; *intrapetiolular glands* subulate, minute, caducous; *post-petiolular glands* small, immersed or subobsolete; *leaves* petioled, the main cauline ones 4–10.5 cm long, with angled and very narrowly margined rachis and (2) 3–5 (6) pairs of obovate to elliptic, short-acuminate to obtuse and mucronulate, sometimes emarginate, flat leaflets 1–3 cm long, all brighter green above, punctate and paler beneath, the leaves of some axillary spurs smaller, with 3–5 leaflets; *peduncles* 1.5–6 (9) cm long; *spikes* densely many-flowered, oblong-ovoid becoming cylindroid, disregarding bract-tails 1.3–1.6 cm diam, the axis becoming 3–15 (20) cm long; *bracts* persistent, papery-membranous, obcordate-navicular, folded around the calyx and keeled dorsally, the body 6–7.5 (8) mm long, in profile 3.5–5.5 mm wide, each side 4-nerved, the livid nerves forking (as in the calyx) and the veinlets anastomosing distally, the wide, lustrously hyaline intervals charged with small honey-colored glands, the tail arising from the distal sinus divaricate and hooked downward, 2–5.5 mm long; *calyx* 2.5–3.4 mm long, glabrous, the tube 2–2.9 mm long, the livid ribs filiform, the plane hyaline intervals charged with 1 row of ± 5–7 minute glands, the orifice oblique, the deltate teeth 0.2–0.7 mm long; *petals* opening greenish-white with finally purple keel-tip, all eventually plum-purple, the banner-blade minutely glandular dorsally, the epistemonous petals perched 4.6–6.3 mm above hypanthium, eglandular; *banner* 7.3–8.2 mm long, the claw 4.2–5.5 mm, the deltate-cordate blade 3.3–4 mm long, 3–4.6 mm wide; *wings* 4.2–5.1 mm long, the claw minute, lateral, the blade broadly lance-oblong, 2–2.3 mm wide, its basal auricle longer than the claw; *keel* 5.2–5.8 mm long, the claws 0.7–1.2 mm, the broadly obliquely obovate blades 4–5.1 mm long, 2.7–3.2 mm wide; *androecium* 10-merous, 8.5–10.8 mm long, the longer filaments free for 1.6–2.2 mm, the connective gland-tipped, the anthers (0.45) 0.5–0.7 mm long; *pod* 2.8–3.2 mm long, obovate in profile, the style-base latero-terminal, the sutures subfiliform, the valves hyaline in lower ⅔, thence papery, glabrous, minutely gland-sprinkled; *seed* 2–2.3 mm long; 2n = 14 (Mosquin). — Collections: 6 (i).

Brushy hillsides on limestone, 1830–2160 m (6100–7200 ft), local but forming colonies, known only from n. Puebla, adjoining Veracruz, and centr. Oaxaca. — Flowering October–December. — *Material*: PUEBLA. Hacienda Noria, near Puebla, *Arsène & Nicolás 5515* (GH, NY, P), *Nicolás in 1909* (G), *in 1910* (L). VERACRUZ. Orizaba, *F. Mueller in 1855* (NY). OAXACA. Etla: 7 mi n. of Telixtlahuaca, *Ripley & Barneby 14,671* (ARIZ, CAS, DAO, F, GH, K, MEXU, MICH, NY, UC, US).

Dalea insignis (distinguished) Hemsl., Diag. Pl. Nov. 7. 1878. — "Mexico: in ditione Verae Crucis, *Müller*, 228..." — Holotypus, labelled "Vera Cruz to Orizaba," K! isotypi

(collected in 1853, some not serially numbered), BR, NY, W! — *Parosela insignis* (Hemsl.) Rose, Contrib. U. S. Nat. Herb. **10**: 103. 1906.

The truly distinguished *D. insignis*, unique in its dilated, veiny bracts which envelop the small calyces in a laterally compressed, boat-shaped sac, is nevertheless closely related to *D. obovatifolia*, especially to its monocarpic, small-flowered var. *uncifera*, hardly different in structure of the flower. The massive spike of bracts, from which the little epistemonous petals, at first greenish white but early fading dull purple, are only shortly and fleetingly exserted, is the most obviously distinctive feature of the plant, but the enlarged foliaceous stipules, resembling the bracts in texture and venation, are equally notable. Here indeed is a clear example of the ontological relationship in Leguminosae between bract and stipules, doubtless homologous structures modifiable by a common genetic rule.

Dispersal of *D. insignis* is still a matter for speculation, the known collections being few and poorly documented. Modern verification of its occurrence in Veracruz is required, for at least some of Mueller's plants labelled as though from Orizaba must have originated not on the moist Gulf slope but on the arid plateau in adjoining Puebla. It is not known for certain how many actual collections are involved in the sets distributed from Puebla by Brothers Arsène and Nicolás, possibly no more than two, both from the same locality and differently dated. I thought it prudent to ignore a specimen (G) attributed to Arsène and labelled "Dos Tebecos, Morelia," which could be part of the pirated material of this collector sent out under fallacious tickets. In reality the species is positively known only from the neighborhood of the city Puebla and from the north end of the valley of Oaxaca.

IVC (vi). Series DRYOPHILAE Barneby

Coarse herbs becoming shrubby and up to 4.5 m tall, densely pubescent; *leaflets* ample, 3–7 pairs; *spikes* racemiform, the pedicels short; *bracts* deciduous; *calyx-tube* slightly recessed dorsally, as long or longer than the teeth, its panels charged with many small glands; *petals* bicolored, the initially whitish (blue-lobed) banner as long as the short-clawed, vivid blue keel, the blade of banner open ventrally at base but with lateral pockets, charged dorsally at base with a small tuft of hairs. — Sp. 1, of highland s. Mexico (Chiapas), Guatemala, and Honduras.

Dalea subgen. **Parosela** sect. **Parosela** ser. **Dryophilae** Barneby, ser. nov., seriei andicolae *Coeruleis* notulis plurimis similes sed allopatricae et calycibus pedicellatis abstantes. — Sp. unica: **D. quercetorum** Standl. & L. Williams.

The one species of ser. *Dryophilae* resembles several of the coarser, larger-flowered Andean *Coeruleae* in habit and in form and coloring of the corolla, but differs from all in its pedicelled flower. The tuft of hairs borne at base of the banner-blade is found, outside ser. *Coeruleae*, also in the Central American *D. dispar*, different in its persistent bracts and yellow petals. The numerous small glands in each panel of the calyx-tube recall some *Pectinatae*, but these have many small, not few large leaflets and truly spicate flowers.

74. DALEA QUERCETORUM Standley & L. Williams
(Plate LXXVI)

Coarse, softly woody herbs and shrubs variable in habit and stature, often flowering the first year as monopodial herbs 0.6–1.5 m tall, later several stemmed from a caudex, or ultimately true shrubs up to 4.5 m tall, the foliage and the young, livid or

greenish, inconspicuously verruculose stems densely silky-pilose or -pilosulous with fine flexuous hairs up to 0.5–1.5 mm long, the leaflets equally pubescent both sides, densely gland-sprinkled beneath, the spiciform racemes mostly terminal to leafy branchlets, forming an open corymbose panicle; *leaf-spurs* 0.7–2.5 mm long; *stipules* linear-caudate, pale or livid, becoming stiff and fragile, 3.5–7 mm long, densely pilosulous and sparsely verruculose dorsally; *intrapetiolular glands* 2–4, spiculiform; *postpetiolular glands* small but prominent, blunt; *leaves* shortly petioled, the main cauline ones (2.5) 3–9 cm long, with stiff, narrowly margined rachis and 3–7 pairs of oblong- or ovate-elliptic to broadly oblanceolate, abruptly short-acuminate, flat, dorsally carinate leaflets up to 1–2.5 (mostly 1–1.5) cm long; *spikes* (racemes) moderately dense, many-flowered, becoming oblong-cylindroid, without petals 12–15 mm diam, the subcontiguous flowers widely spreading-ascending, the densely pilosulous axis (1) 2–14 cm long; *bracts* deciduous, 3–6 (8) mm long, the body broadly lanceolate, navicular, keeled dorsally, castaneous except for scarious-margined base, 2–4 (4.5) mm long and in profile 1–1.6 mm wide, tapering or abruptly contracted into a livid tail 1.5–2.5 (3.5) mm long, the whole pilosulous dorsally throughout or almost so, glandless or minutely gland-sprinkled, glabrous within; *pedicels* up to 0.3–0.7 mm long, sometimes almost 0; *calyx* 5.5–7.5 mm long, finely and densely pilose with spiral hairs up to (0.8) 1–1.4 mm long, the tube 2.7–3.7 mm long, somewhat recessed behind banner, the orifice moderately oblique, the slender, livid-castaneous or rarely pallid ribs becoming prominent, the membranous flat intervals charged with many small scattered, golden or honey-colored glands, the lance- or triangular-cuspidate gland-tipped and -spurred teeth unequal, the dorsal one longest, 2.2–4 mm long (as long to 1.2 mm shorter than tube), the ventral pair shortest; *petals* bicolored, the banner white distally, rubescent, its basal lobes blue-tipped, charged with a few glands in the eye and dorsally above top of claw with a small tuft of hairs, sometimes like the keel minutely gland-tipped, the epistemonous petals deep vivid blue fading violet-blue, paler along outer edges, perched well below middle of androecium (± 2.2–3.8 mm above hypanthium); *banner* 6–7 mm long, the claw 3.2–3.8 mm, the suborbicular emarginate blade callous but not recessed into a cornet at base, 3–3.8 mm long, 3–4 mm wide, its lobes inflexed and adherent to form lateral pockets; *wings* 5.5–5.8 mm long, the claw 1.2–1.7 mm, the ovate-oblong blade 4.3–4.7 mm long, 2–2.2 mm wide; *keel* 6–7.3 mm long, the claws 1.7–2.4 mm, the elliptic blades 4.7–5.5 mm long, 2.7–3.1 mm wide; *androecium* 10-merous, 7–9 mm long, the longest filaments free for 1.7–2.5 mm, the connective gland-tipped, the anthers 0.55–0.7 mm long; *pod* in profile triangular or triangular-obovate, 2.6–3.4 mm long, the style-base latero-terminal, the prow slenderly keeled, the valves hyaline in lower ⅔, thence thinly papery, minutely gland-sprinkled, pilosulous with fine spiral hairs; *seed* castaneous, 2–2.9 mm long. — Collections: 10 (o).

Habitat little known, but at least sometimes in oak-pine woods, ± 1500–1700 m, apparently local and discontinuous: highlands of Chiapas, Mexico (mpos Amatenango del Valle, Comitán, La Trinitaria); s.-e. Guatemala, mostly within or near the drainage of Río Motagua (dptos Baja Verapaz, Jalapa, Zacapa), and Honduras (dptos Comayagua, El Paraíso, Intibucá). — Flowering November through February. — *Material*: MEXICO. CHIAPAS: *Miranda 5014* (MEXU); *Matuda 6022* (F, MEXU); *Breedlove & Raven 8363* (US). GUATEMALA. BAJA VERAPAZ: *Molina & Molina 12,353* (F, NY). JALAPA: *Steyermark 33,127* (F). ZACAPA: *Steyermark 42,936* (F), *43,186* (F, NY). HONDURAS. COMAYAGUA: *Yuncker et al. 6238* (F, sterile); EL PARAÍSO: *Molina 13,075* (F, NY). INTIBUCÁ: *Molina & Molina 24,287* (NY); *Standley 25.191, 25,268* (F, topotypi).

Dalea quercetorum (of oak-woods) Standl. & L. Wms., Ceiba **1**: 82. 1950. — HONDURAS: Dept. Intibucá: Cerca de La Esperanza...En. 31–Feb. 12, 1950, *Standley 25454*..." — Holotypus, olim in herb. Esc. Agr. Panam., hodie US!

Dalea leucosericea sensu Standl. & Steyerm., Field Mus. Bot. Ser. **24**[5]: 213. 1946; non *Parosela leucosericea* Rydb.

A coarsely leafy dalea, readily recognized by floral characters: glands in intercostal membranes of calyx numerous, scattered; petals except for the partly white banner vivid blue; banner about as long as keel and bearing on back a small tuft of hairs. Of sympatric species only *D. dispar* has a similar banner, but combined with greenish-yellow petals and vertically uniseriate glands in the calyx-membranes. Both these species flower precociously as tall, simple-stemmed herbs branched distally into a panicle of spikes but later become soft shrubs, *D. quercetorum* reportedly up to 4.5 m tall. The phases of maturity are well shown by *Steyermark 42,936* (monopodial herb), *Steyermark 33,127* (suffruticose, with several virgate stems), and several collections consisting of branches taken from shrubs of variable stature. Independently of stature, the pubescence of the stems varies from relatively thin and forwardly subappressed, not fully concealing the chestnut-purple epidermis, to very dense, horizontally spreading, and shaggy. The pedicels, ordinarily well-developed, are sometimes short or obscure. The leaflets of some pressed specimens show a characteristic sleep-movement, becoming reflexed, the members of each pair back to back, and retrorsely imbricated.

As implied in the synonymy, I have referred to *D. quercetorum*, described from Honduras, the Guatemalan plants assigned by Standley & Steyermark to *D. leucosericea*, a species sometimes similar in its dense, when fresh silvery (in dried specimens early tarnished) pubescence of long, glossily silky hairs, but different in the always sessile calyces subtended by flatter, internally silky bracts, uniseriate glands in the calyx-intervals, pinkish-lavender petals, and dorsally glabrous banner substantially shorter than the detached keel. The known ranges of *D. leucosericea*, not known to occur southeast of central Oaxaca, and *D. quercetorum*, with its western limit in highlands of eastern Chiapas, are so far apart that no further confusion of the two seems likely,

IVC (vii). Series Dispares Barneby

Tall, softly woody herbs becoming shrubby; *leaflets* large, 5–10 pairs; *spikes* racemiform (pedicels short but apparent); *bracts* persistent; *calyx-tube* subsymmetric, the teeth as long or shorter; *petals* greenish-yellow fading brownish, the long-stalked banner slightly longer than the detached keel and its blade charged dorsally at base with a tuft of hairs. — Sp. 1, of highland Guatemala.

Dalea subgen. **Parosela** sect. **Parosela** ser. **Dispares** Barneby, ser. nov., affinitatis ignotae sed foliolis expansis, floribus pedicellatis bractea persistenti suffultis, petalis lutescenti-viridibus sordescentibus, et vexilli longe unguiculati lamina dorso barbulata insignes. — Sp. unica: **D. dispar** Morton.

As noted by Morton in the protologue, *D. dispar* has no obvious relative in the genus. The sympatric *D. quercetorum*, equally isolated taxonomically, resembles *D. dispar* technically in the presence of short pedicels and a tuft of hairs on back of the banner table, but differs in its deciduous bracts, the multiseriate small glands in the panels of the calyx-tube, and vivid blue coloring of the high-perching epistemonous petals, not to mention the few leaflets and silky vesture. These two Central American species have features in common with the Andean *Coeruleae*, notably the dorsally barbulate banner, but differ collectively in the presence of pedicels and severally in many small characters. Of daleas with

petals opening yellowish none but *D. dispar* has dorsally pubescent banner and *D. melantha* alone has short-pedicelled flowers; the latter differs in its deciduous interfloral bracts, short-stalked banner, and elongate calyx-teeth.

75. DALEA DISPAR Morton
(Plate LXXVII)

Coarse, soft-woody herbs, at anthesis 6–20 dm tall, at first monopodial, distally branching, becoming shrubby in age, appearing glabrous up to the inflorescence but the purplish-brown tuberculate young stems, the stipules, and leaf-rachises (or some of them) thinly pilosulous with scattered weak spiral hairs up to 0.2–0.6 mm long, the old wood becoming brown and furrowed, the foliage green, the leaflets somewhat bicolored, smooth above, beneath paler, faintly penni-nerved, densely punctate; *leaf-spurs* 1–1.6 mm long; *stipules* linear-caudate or linear, (3) 4.5–10 mm long, at least thinly pilosulous distally and ciliolate; *intrapetiolular glands* spiculiform; *post-petiolular glands* prominent, mammiform or prickle-shaped; *leaves* shortly petioled, the main cauline ones 5–11 cm long, with pale, punctate, narrowly thick-margined rachis and 5–9 (10) well-separated pairs of elliptic-oblanceolate or -obovate, abruptly acute or short-acuminate, flat, dorsally keeled leaflets up to 1–1.8 cm long, the margins often minutely gland-crenulate distally, the terminal leaflet stalked, scarcely smaller than the last pair; *peduncles* 0–1.5 cm long, the first of each major axis often surpassed by several smaller ones terminal to lateral branchlets; *spikes* racemiform, moderately dense, ovoid-oblong becoming cylindroid, without petals (but including bracts) 14–18 mm diam, the pilosulous axis becoming 2.5–14 (17) mm long; *bracts* persistent, lance-caudate, 5–10 mm long, the navicular body in profile (0.6) 0.8–1.3 mm wide near base, narrowly pale-margined, green or livid and glabrous dorsally, tapering distally into a livid, ciliolate or glabrate tail nearly as long or longer than the body; *pedicels* 0.2–0.5 mm long; *calyx* 5.3–7 mm long, pilose or pilosulous with fine ascending spiral hairs up to 0.6–1.6 mm long, the tube always thinly so and sometimes glabrous, (2.7) 3–4.6 mm long, slightly recessed behind banner, the yellow or castaneous ribs becoming salient, the flat membranous intervals charged with 1 row of large, elliptic, often irregularly confluent blister-glands, the triangular-acuminate, gland-spurred teeth subequal or the dorsal one a little the longest, 2.7–3.4 mm long (0–1.2 mm shorter than tube), the ventral pair shorter and broader; *petals* greenish-yellow turning sordid or dull brownish-rose, the banner marked with a lobed greenish eye and charged on back of blade with a tuft of hairs, usually (like the keel) gland-tipped but otherwise glandless, the epistemonous ones perched much below middle of androecium (2–3.5 mm above hypanthium); *banner* (7.5) 8–10.4 mm long, the stout 3-gonous claw 4.5–6.3 mm, the broadly ovate, slightly recurved, shallowly hooded blade 3.2–4.4 mm long, 3.2–4.6 mm wide, callous but open at base and the lobes incurved and adherent to form lateral pockets; *wings* 5.3–6.9 mm long, the claw 1.6–2.9 mm, the oblong-ovate blade 4–5.3 mm long, 1.7–2.5 mm wide; *keel* 7.4–8.8 mm long, the claws 2.8–3.8 mm, the elliptic or obovate-elliptic blades 4.5–5.3 mm long, 2.9–3.5 mm wide; *androecium* 10-merous, 9–11 mm long, the longer filaments free for 2.4–3.2 mm, the connective minutely gland-tipped, the anthers 0.55–0.65 mm long; *pod* ± 3 mm long, obliquely obovate in profile, hyaline and glabrous in lower ⅔, thence thinly papery, hirsute, gland-sprinkled; *seed* olive-buff becoming castaneous, ± 2 mm long. — Collections: 10 (o).

Thickets and at the edges of oak-pine woodland, coming out weedily to fallow milpa and along lanes or railroads, 1600–2600 m (5330–8670 ft), apparently not uncommon in the highlands of s. Guatemala from Quetzaltenango e. to Jalapa and Jutiapa, to be expected in Salvador and to be looked for in the coastal cordillera of s. Chiapas. — Flowering late November to February (April). *Material*: QUETZALTENANGO: along railroad above Zunil, *Steyermark 24,477* (F). SOLOLÁ: Panajachel waterfalls, road to Sololá, *Molina et al. 16,254* (NY). CHIMALTENANGO: Los Positos above Las Calderas, *Standley 80,268* (F); Chichavac, *Skutch 725* (US). SACATEPEQUEZ: Pachali near San Lucas, *Edgar Anderson 4603* (F); San Rafael, *Donnell Smith 2272* (GH, pod in dec, US, fl in apr); Volcán de Agua n. of Sta. María de Jesús, *Standley 59,348* (NY, US). JALAPA: Jalapa to Montaña Miramundo, *Steyermark 32,886* (F). JUTIAPA: Volcán Suchitán, n.-w. of Asunción Mita, *Steyermark 31,897* (F). Guatemala, s. loc., *Aguilar 714* (F).

Dalea dispar (unmatched) C. V. Morton, Phytologia **1**: 147. 1939. — "Type collected at Chichavac, Dept. Chimaltenango, Guatemala, alt. 2400–2700 meters, February 18, 1933, by F. A. Skutch (*No. 259*)..." — Holotypus, US! isotypi, GH, NY!

A species of marked technical distinctness, notable for the combination of linear stipules, large acute leaflets, persistent, papery interfloral bracts, yellowish petals, and long-stalked banner hairy on the back. Of North American daleas the sympatric *D. quercetorum* alone resembles it in the pubescent banner, but this is a feature widespread among the Andean species with similar foliage. All of these, however, have blue petals. Where *D. quercetorum* and *D. dispar* grow together the former will be easily recognized not only by flower-color but by the dense silky pubescence of the foliage and the multiseriate small glands in the panels of the calyx-tube.

According to the protologue, the flower of *D. dispar* is nonandrous, but this character must have been observed in an anomalous flower, all examined since having the full complement of ten fertile stamens.

During preliminary study I provisionally identified *D. dispar* with the obscure *D. macrostachya* Moric., said to be from Nueva España (Mexico or Central America) and characterized by a dorsally hairy standard. The typus of *D. macrostachya*, which I was unable to locate at Genève in 1963, was later sent on loan to New York and proved to represent a form of the South American *D. coerulea*. Several misleading annotations had unfortunately passed out of my hands before the error was discovered.

IVC (viii). Series JAMESONIANAE Barneby

Shrubs; *leaflets* 3–6 pairs; inflorescence a loose, few-flowered raceme, the flowers spreading or nodding on densely silky-pilosulous pedicels 0.7–1.5 mm long; *calyx* short-toothed, glabrous and vernicose externally; *flowers* large, bicolored, the epistemonous ones intense blue-purple. — Sp. 1, of Ecuador.

Dalea subgen. **Parosela** sect. **Parosela** ser. **Jamesonianae** Barneby, ser. nov., a ser. *Coeruleis* inflorescentia laxe racemosa nec spicata absimiles. — Sp. unica: **D. jamesonii** (Macbr.) Macbr.

76. DALEA JAMESONII (Macbride) Macbride
(Plate LXXVIII)

Slender sparsely leafy shrubs up to 1.5–2 m tall, the old stems glabrate fuscous, the young branchlets smooth or remotely low-tuberculate, silky-strigulose with fine

subappressed hairs up to 0.2–0.4 mm long, the foliage green, the leaflets smooth and glabrous above, paler, silky-strigulose and densely tuberculate beneath; *leaf-spurs* 0.6–1.6 mm long; *stipules* narrowly subulate, 1.5–4.5 mm long, strigulose dorsally; *intrapetiolular glands* 2, small, obtuse; *post-petiolular glands* larger, protuberant; *leaves* shortly petioled, the primary cauline ones 2–4 cm long, with narrowly margined, punctate rachis and 3–5 (6) pairs of broadly oblanceolate to narrowly obovate, subacute or obtuse and apiculate, gland-mucronulate, flat or marginally involute to loosely folded leaflets 7–12 mm long, the terminal leaflet sessile, the uppermost leaves smaller, with 2–3 pairs of shorter leaflets; *peduncles* leaf-opposed and terminal to branchlets, (1) 1.5–6 cm long; *racemes* loosely (6) 9–30 (35)-flowered, the flowers spreading or subsecundly nodding, the silky-strigulose axis 1.5–4 cm long; *bracts* early deciduous, ovate, short-acuminate, 4–5.5 mm long, firm throughout, dorsally strigulose and thinly verruculose; *pedicels* erect, 0.7–1.5 mm long, densely silky-villosulous; *calyx* at anthesis 7–7.7 mm long, the basally constricted and oblique tube 4.4–4.7 mm long, a trifle accrescent in age, firm, externally glabrous, golden-brown or atrocastaneous and vernicose, bluntly ribbed and shallowly pleated, the broad intervals charged with usually 1 row of 4–6 elliptic golden glands, the teeth and orifice silky-villosulous with ascending hairs up to 0.4–0.6 mm long, the teeth subequal or the dorsal one a trifle longer, subulate from a deltate-triangular base, gland-spurred and -tipped, the dorsal tooth 2.6–3 mm long (1.4–2 mm shorter than tube); *petals* bicolored, the greenish-white, copiously gland-sprinkled blade often blue-margined laterally at base, the epistemonous ones intense purple-blue, perched below middle of androecium (2.5–5 mm above hypanthium), glandless or the keel (like the banner) gland-tipped; *banner* 7.8–10.5 mm long, the claw 3.6–5 mm, the suborbicular-cordate blade 5.6–6.7 mm long, 6.8–7.4 mm wide, the basal lobes incurved but not adherent, the shallow cornet opening ventrally; *wings* 8.2–9.6 mm long, the claw 1.8–3 mm, the obliquely lance-elliptic blade 7.3–7.7 mm long, 3–3.2 mm wide, the reflexed auricle large; *keel* 9.5–12.5 mm long, the claws 2.3–4.7 mm, the narrowly elliptic blades 7.5–9 mm long, 3.2–3.4 mm wide; *androecium* 10-merous, 9.5–12.5 mm long, the longer filaments free for 3.8–4.5 mm, the connective gland-tipped, the bluish anthers 0.9–1.1 mm long; *pod* ± 4.5 mm long, obliquely triangular in profile, the style-base terminal, the prow slenderly carinate, the valves hyaline and glabrous in lower ⅓, thence thinly papery, villosulous, and sparsely gland-sprinkled; *seed* ± 2.8 mm long. — Collections: 6 (o).

Thickets and brushy hillsides, 2100–3200 m, very local, known with assurance only from the upper valley of Río Paute, between Cuenca and Azogues and vicinity, in Cañar and Azuay, Ecuador. — Flowering September to February, perhaps through the year. — *Material*: CAÑAR: Azogues, *Rose & Rose 22,790* (NY, US). Azogues to San Marcos, *F. Prieto P-180* (NY, UC). AZUAY: Gualaseo (typus). Río Paute e. of Cuenca, *M. A. Giler 16* (NY). Río Paute "near Quito", *Jameson s. n.* (K, herb. Benth., herb. Hook.). _____ "Colombia", *herb. Mutis.* (US).

Dalea jamesonii (Macbr.) Macbr., Candollea **7**: 223. 1937, based on *Parosela jamesonii* (William Jameson, 1796–1873) Macbr., Field Mus., Bot. **4**: 112. 1927. — 'ECUADOR: Guaceo [= Gualaseo], Prov. of Cuenca, Sept., 1864, *Jameson...*" — Holotypus, US! isotypus (*Jameson 93*), K! clastotypus (fragm.), F!

The only Andean dalea with pedicelled flowers, *D. jamesonii* is a small, awkwardly branching, sparsely leafy shrub, notable for the externally glabrous, vernicose, short-toothed calyces and long, narrow keel of exceptionally dark and vivid blue coloring. The fruticose dalea common in and near the range of *D. jamesonii* is *D. coerulea*, similar in form and color of the petals, but sharply marked by its spiciform inflorescence and long,

plumose calyx-teeth. The presence of pedicels is probably in most cases a primitive character in *Dalea*, but perhaps not in *D. jamesonii*, which suggests a specialized derivative of ser. *Coeruleae* rather than a relic species.

IVC (ix). Series Coeruleae Barneby

Herbs, perennial but often precociously flowering, one (*D. tapacariensis*) possibly monocarpic, and shrubs up to 3, rarely 5 m tall, the smooth or strongly verruculose stems and foliage, at least when young, ± pilosulous, sometimes inconspicuously so, sometimes densely tomentose-canescent; *leaflets* 4–18 pairs, mostly expanded, seldom small and carnosulous, the terminal one either stalked or sessile; *spikes* loose or dense, but not conelike; *bracts* either persistent or deciduous, the navicular, ± broadly membranous-margined body clasping base of calyx, contracted or tapering upward into a tail; *calyx-tube* symmetrical or oblique at orifice but not recessed behind banner, the membranous intervals charged with 1 row of discrete glands, rarely with several scattered glands, the glands exceptionally confluent into 1–3 parallel, elongately linear ones; *petals* with few exceptions bicolored, the usually ample banner opening whitish with green eye-spot, rubescent, gland-sprinkled, its (often blue-purple) basal lobes ± incurved, often adherent to ventral face of blade to form lateral pockets, exceptionally recessed at claw into a cornet, the epistemonous petals commonly blue, less often rose- or amethyst-purple, rarely (*D. cylindrica* vars.) pale yellow like the banner, exceptionally (*D. tapacariensis*) white like banner, but the wings then blue-tipped, of whatever color perched well below middle of androecium, the detached keel scarcely or considerably longer than banner, its blades ± 2–8.5 mm long. — Spp. 19, several composed of two or more geographic races, all Andean, ranging mostly at middle altitudes from n. Colombia to n.-w. Argentina and n. Chile.

Dalea subgen. **Parosela** sect. **Parosela** ser. **Coeruleae** Barneby, ser. nov., a ser. *Parosela* praesertim petalis epistemoneis multo infra medium androecium insertis, vexillo amplo sed carinae delapsae fere semper subbreviori, facilius patria austro-americana andina segregendae. — Sp. typica: **D. coerulea** (L. f.) Schinz & Thell.

The Andean daleas other than the native representatives of ser. *Thyrsiflorae* and the weedy *D. leporina* of subgen. *Dalea* form an obviously interrelated group, notable for a great range of stature, habit, and flower-size, but singularly little modified in form of the flower. The species are for the most part inherently difficult to define, although many are recognizable by an idiosyncratic facies confirmed by factors of dispersal. While the form (but not the size) of the flower is in general monotonously uniform, there are three remarkable exceptions standing out from the herd, each treated herein as forming a monotypic series: *Jamesonianae*, unlike all the rest in its loose raceme of pedicelled flowers; *Galbinae*, unique in *Dalea* because of its 20-ribbed calyx combined with pale yellow petals; and *Moquehuanae*, filiform annuals of Pacific southern Peru with relatively high-perching, degenerate epistemonous petals and an androecium reduced to seven members, only five fertile. The remainder, forming ser. *Coeruleae*, can be divided, following Macbride, into two groups by relative length of calyx-tube and teeth, the latter longer than the tube and drawn out into an aristiform point in *D. coerulea* and *D. ayavacensis*, in the rest triangular or deltate and shorter than the tube. Individual difficulties arise in a few cases where the dorsal tooth and tube are of about equal length, but these are few and do not seriously impair the usefulness of the character. The same may be said of the interfloral bracts, in some species deciduous by full anthesis, in others long-persistent, but in *D. weberbaueri*

not always clearly one or the other. Beyond these differential characters the taxonomist is thrown back on leaflet-number, seldom decisive but often helpful, on rather minute measurements of calyx and petals (the keel always most reliable and happily most easily observed), and on features of habit, often treacherous and still poorly understood.

The basic taxonomy of the *Coeruleae* was worked out over a period of years by J. F. Macbride, who published two major papers dealing with the group in whole or in great part. The first (1927, under *Parosela*) was based on material at GH, F, PH, and US; the material in European herbaria, including types of Ulbrich's many species based on collections of August Weberbauer, had not been seen, and these were interpreted from the descriptions in an admittedly provisional manner. The second revision, for *Flora of Peru* (1943) is more sophisticated, but still partly incoherent. Macbride had by then seen and photographed at Berlin and Geneva many capitally important specimens, and had begun to realize that features of habit and pubescence, which had prompted an excessive number of descriptions, were fallible; but he lacked, as we still lack, the data necessary to understand what are the real discontinuities in nature as opposed to the discontinuities that appear in the herbarium record. The over-description of Andean *Dalea* can be ascribed in part to an inherent variability, in part to uncoordinated duplication of studies at different herbaria, and in part to misunderstanding of certain basic variational patterns latent throughout the genus but particularly accentuated under montane tropical conditions. Here, where seasons are poorly marked and growth, for plants of fundamentally xerophytic nature, can continue throughout the year, the individual organism can assume greatly different facies according to age and site, flowering first, perhaps, as a monopodial herb but later growing up, in sheltered places, to achieve the stature of a rounded bush or even a small treelet, or conversely, in thin soil, or where persecuted, remaining a diffuse, thyme-like shrublet.

The present account, in which some measure of compression has been attained, is still, at least in places (as discussed under each species below), hardly less tentative than those of Macbride. The entities present in the Andes of southern Peru and southward seem pretty well understood, but a case could be made for further reductions in status, and consolidation into larger, internally polymorphic but better differentiated units. I have attempted this only where the evidence seemed compelling; more will doubtless be found necessary. In northern Peru, especially in Cajamarca and La Libertad, where a bewildering constellation of forms occur close together, the situation is much more difficult and cannot be understood without extensive field-work. I am unhappily aware that the story here is only beginning to unfold.

Key to Species of Ser. *Coeruleae*

1. Tube of calyx (measured from base to dorsal sinus) shorter than the longest (dorsal) tooth; *interfloral bracts* persistent.
   2. Glands in each panel of the calyx 1–several, if more than 1 arranged in a vertical (sometimes irregular) rank through the middle of the intercostal membrane, midway between the ribs, the glands themselves elliptic or orbicular, not over 1 mm long. Colombia to centr. Peru, common (if of Colombia n. from Bogotá and calyx densely silky-pilosulous from base upward, cf. *D. cuatrecasasii*). 77. *D. coerulea* (348)
   2. Glands in each panel of the calyx 2 (3), linear, much over 1 mm long, the pair always present running vertically at either edge of the intercostal membrane adjacent to the ribs, a third sometimes interposed; s. Ecuador to centr. Peru, rare. 78. *D. ayavacensis* (p. 352)

1. Tube of calyx (measured to dorsal sinus) longer than the dorsal tooth; *interfloral bracts* either deciduous or persistent.
   3. Flower large, the keel-blades 5 mm long or more.
      4. Plants of centr. and n. Colombian Andes, shrubby, resembling sympatric forms of *D. coerulea* but the interfloral bracts deciduous and the calyx densely silky-pilosulous from base upward. 79. *D. cuatrecasasii* (p. 355)
   4. Plants of Ecuador, Peru, and n. Chile and Argentina.
      5. Interfloral bracts thrown off before full anthesis; Peru and n.-w. Chile.
         6. Dispersal transmontane in Peru, from Huancavelica to Cuzco; suffruticose, ± 4–10 dm tall, foliage green. 87. *D. smithii* (p. 373)
         6. Dispersal cismontane in Peru and n.-w. Chile.
            7. Relatively tall and northern plants, the stems (ascending or diffuse) 6–15 dm tall, the range extending from Arequipa (Condesuyos), Peru n. to Cajamarca; *body of bracts* relatively broad, in profile 1.6–2 mm wide and the width : length ratio ± 1 : 2; *dorsal calyx-tooth* 1–1.8 mm long. 84. *D. onobrychis* (p. 369)
            7. Relatively low and southern plants, the stems 3–6 dm tall, the range extending from Arequipa, Peru, into n. Chile; *body of bracts* narrower, in profile 1.2–1.5 mm wide and the width : length ratio ± 1 : 2.5–3.5; *dorsal* calyx-tooth 1.8–3.1 mm long.
               8. Herbs, humifuse, the peduncles obliquely ascending, the relatively loose and narrow spikes incurved to vertical; *habitat* on dry hillsides at 2000+ m in Arequipa, Peru, and adjoining Tarapacá, Chile; *dorsal calyx-tooth* 1.8–2.5 mm long; *petals* amethystine violet. 85. *D. pennellii* (p. 370)
               8. Small erect shrubs, the fruticose stems terminating in massive erect spikes permanently dense; *habitat* in fog-desert of coastal Antofagasta, Chile; *dorsal calyx-tooth* 2.2–3.1 mm long; *petals* vivid blue. 86. *D. azurea* (p. 372)
      5. Interfloral bracts persistent through anthesis, usually until fall of the ripe calyx and pod.
         9. Dispersal southeastern, from Ayacucho to Cuzco in Peru and thence s.-e. over the Bolivian Plateau into Argentina, entirely transmontane.
            10. Leaflets of primary cauline leaves 4–11 pairs.
               11. Leaflets elliptic to obovate or obcordate.
                  12. Erect shrubs or subshrubs 0.6–1 m tall; *leaflets* of primary leaves 7–11 pairs, obtuse to acute and glandmucronulate; Bolivian plateau, sympatric with the next. 88. *D. pazensis* (p. 375)
                  12. Diffuse or prostrate herbs with flexuous, mostly decumbent or humifuse stems 0.5–4.5 dm long radiating from the root-crown or a short caudex; *leaflets* of primary leaves mostly 4–8 (9) pairs, broadly obovate-oblong to obovate-emarginate or obcordate; s.-e. Peru through the Bolivian Plateau to n.-w. Argentina. 91. *D. boliviana* (p. 381)

11. Leaflets linear to linear-lanceolate; local in s. Bolivia. 89. *D. kuntzei* (p. 376)

10. Leaflets of primary cauline leaves 10–16 pairs; Argentina and just entering s. Bolivia. 90. *D. elegans* (p. 378)

9. Dispersal northern and western, wholly in Peru, from Huancavelica n.-ward on the transmontane slope and from Arequipa n.-ward on the cismontane slope. Spp. critical, especially in n. Peru.

12. Foliage permanently gray-silky; *petals* blue, violet or purple.

13. Stipules lanceolate, tapering from a dilated base; *dorsal calyx-tooth* 1.3–2.3 (2.5) mm long, 1.2–2.1 mm shorter than tube; *peduncles* up to 6 cm long but often very short or subobsolete and terminal to leafy branchlets; *leaflets* up to 4–8 mm long, firm or thick-textured; widespread in centr.-northern Peru. 82. *D. weberbaueri* (p. 365)

13. Stipules linear-setiform; *dorsal calyx-tooth* 2.5–3 mm long, 0.1–0.8 mm shorter than tube; *peduncles* mostly leaf-opposed, 5–9 cm long; *leaflets* submembranous, up to 7–14 mm long; local in Pasco. 83. *D. fieldii* (p. 368)

12. Foliage green or early becoming so, or if rarely gray-silky then (*D. cylindrica* var. *sulfurea*) the petals all pale yellow.

14. Teeth of calyx all triangular, narrowly deltate, or lanceolate, but the ventral pair even though shorter than the dorsal one not broader than long; widespread and polymorphic. 80. *D. cylindrica* (p. 357)

14. Teeth of calyx proportionately very short and broad, the dorsal one triangular-deltate, the ventral and lateral pairs depressed-deltate and broader than long; local in upper Marañón valley in Cajamarca and Amazonas. 81. *D. myriadenia* (p. 364)

3. Flower small, the keel-blades less than 5 mm long.

15. Dispersal southeastern, from Ayacucho to Cuzco and s.-ward through Bolivia.

16. Keel and wings blue, only the banner white; decisively perennial or fruticose; return to dichotomy 12/12.

16. Keel and banner white, only the wing-tips blue; small-flowered annual herbs of the Bolivian Plateau (Cochabamba). 95. *D. tapacariensis* (p. 388)

15. Dispersal northern and western, on the transmontane slope in Peru n.-ward from Huancavelica, on the cismontane slope in Lima and Moquegua; n. to Ecuador.

17. Foliage densely and permanently pannose-tomentulose (silvery, turning golden when dried), the vesture concealing the dots on the lower leaf-face; *leaflets* broadly oblong-elliptic or obovate, obtuse, flat or nearly so; s. Ecuador. 94. *D. chrysophylla* (p. 387)

17. Foliage glabrous or moderately pubescent, but if densely so the leaflets of a narrower type, or strongly folded, or acute, the vesture in any case not concealing the dots on the lower leaf-face; Ecuador s.-ward, widespread.

18. Keel-blades 3–4.2 mm long; *leaflets* mostly 5–8 pairs, the primary cauline leaves 1.5–4.5 cm long; inter-Andean Peru from Amazonas s.-ward. 92. *D. exilis* (p. 383)

18. Keel-blades 2–3 mm long; *leaflets* mostly 2–5 pairs, the primary leaves 0.7–1.6 cm long; pumice soils of the Ecuadorean Andes. 93. *D. humifusa* (p. 386)

77. DALEA COERULEA (Linnaeus fil.) Schinz & Thellung
(Plate LXXIX)

Irregularly branching shrubs up to 1.5–3, rarely 5 m tall, sometimes precociously flowering as suffrutescent herbs, with castaneous or livid, low-tuberculate and striate branches, pilosulous throughout or nearly so with fine soft ascending and subappressed, finally rufescent or golden hairs up to 0.3–0.6 mm long, the young foliage silky-canescent becoming green or greenish, the leaflets glabrous above, pubescent and punctate beneath, the vesture often becoming longer, looser and denser toward the inflorescence, the peduncles sometimes loosely hirsute distally; *leaf-spurs* 0.8–2 mm long; *stipules* narrowly subulate to linear-caudate, reddish or livid becoming fuscous and fragile, 1.3–4 mm long; *intrapetiolular glands* spiculiform, up to 0.2–1 mm long; *post-petiolular glands* rather small, rounded or conic; *leaves* shortly petioled, the main cauline ones (2.5) 3–11 cm long, with narrowly thick-margined rachis and 5–9 pairs of oblong, oblong-obovate, elliptic-oblanceolate, rarely obovate-cuneate, obtuse or subacute, gland-mucronate, dorsally carinate, flat or loosely folded leaflets 6–16 (20) mm long, the leaves of some axillary spurs shorter, with few (3–6) pairs of smaller leaflets; *peduncles* 1–2 leaf-opposed and subsequently several terminal to leafy branchlets, (0) 1–9 (11) cm long; *spikes* many-flowered, dense (or looser near base) but not conelike, narrowly ovoid and blunt-tipped becoming cylindroid, without petals or androecia 11–18 mm diam, the calyces subcontiguous and (pressed) several-ranked, the densely silky-pilosulous axis becoming 3–14 cm long; *bracts* persistent at least till past anthesis, the body (2.5) 3–4.3 mm long, broadly ovate or ovate-oblong, clasping the flower-buds, in profile (1.2) 1.4–2.1 (2.3) mm wide, papery-castaneous within the submembranous margins, dorsally keeled and either subglabrous or thinly pilosulous to pilose, abruptly contracted or tapering into a divaricate tail much shorter than or up to ± as long as body, mostly 0.5–3.5, rarely 4.5 mm long; *calyx* (5.2) 5.4–8.4 mm long, pilose on tube or teeth or both with fine ascending, finally divaricate hairs up to (0.6) 0.8–1.6 (2) mm long, the tube 2.4–3.2 (3.7) mm long, the prominent ribs castaneous or livid, the membranous intervals charged with at least 1 or up to 5 (6) glands variable in size and color, the orifice subsymmetrical, the teeth triangular at base, contracted into a stout mucro or flexuously spreading, gland-spurred arista, nearly always somewhat unequal, the dorsal one longest, varying from as long up to ± twice as long as tube; *petals* bicolored, the banner opening white except for blue-tipped lobes, early rubescent, with a 1-lobed greenish spot and a cluster of glands near the eye, at least dorsally and sometimes ventrally pilosulous near base of blade, the epistemonous petals commonly ultramarine or cobalt blue, rarely violet- or magenta-purple, exceptionally white (albino), perched at 1.2–2.8 (3.1) mm above hypanthium, the blades gland-tipped; *banner* 5.3–8.4 (9.6) mm long, the claw 2.4–4.2 (4.8) mm, the broadly obovate-cordate, emarginate blade (3.3) 3.5–5 (6) mm long, 3.8–5.2 (5.8) mm wide; *wings* (5) 5.6–7.9 (9.8) mm long, the claw (1.7) 2–2.9 (3.4) mm, the oblong, elliptic, or elliptic-obovate blades 4.3–5.8 (6.4) mm long, 1.8–3.2 (3.7) mm wide; *keel* 6.8–11.6 (12) mm long, the claws 2.3–4.7 mm, the broadly ovate-elliptic blades (4.8) 5–8.2 mm long, 2.4–4.7 mm wide; *androecium*

10-merous, 7–14 mm long, the filaments free for up to 2.2–4.2 mm, the connective gland-tipped, the anthers 0.5–0.9 mm long; *pod* varying from obliquely obovate to obtusely deltate in profile, 2.6–3.2 mm long, the style-base latero-terminal, the prow slenderly keeled, the valves hyaline in lower half, thence thinly papery, pilosulous, sparsely gland-sprinkled; *seed* ± 2 mm long.

As described and defined herein, *D. coerulea* is a variable and polymorphic species dispersed along the Andes, mostly east of the Divide, from latitude 8° 20′ N in Colombia's Cordillera Oriental south to 13° 10′ S in the gorge of the Urubamba in Cuzco, Peru. Between Bogotá and the headwaters of Río Marañón in Peru it is the commonest and most often collected member of the genus, readily recognized by its tall shrubby habit, ample leaflets glabrous above, and thick, densely flowered spikes of handsome blue and white flowers. With the exception of sympatric but uncommon *D. ayavacensis*, set off (perhaps artificially) by the pairs of linear glands occupying the length of each intercostal membrane of the calyx, it is the only dalea of its type characterized by long calyx-teeth, the dorsal one varying from as long up to twice as long as the tube. Over a great central segment of its range *D. coerulea* is sympatric with the habitally similar, also blue-flowered *D. cylindrica* var. *nova*, and in Cajamarca apparently intergrades with it. The apically glabrate, corneous-margined calyx-teeth of var. *nova*, ordinarily all decisively shorter than the tube, are its best differential characters.

The numerous races of *D. coerulea* differ one from the next in length of spike, in length of bracts, in flower-size (and consequently in thickness of the spike), in gland-patterns on the intercostal calyx-membranes, and particularly in the length and dispersal of hairs over the calyx-tube and teeth. Most commonly, in Colombia almost always, the calyx-tube is glabrous and lustrous, contrasting with plumosely ciliate teeth, and a calyx of this type, varying however in proportion of its parts, prevails through the range of the species. In Ecuador and sporadically southward the tube is pilose in varying degrees, sometimes only around the orifice, but sometimes only at base, or only on the dorsal side, or from the base upward its whole length. Every stage from hairless to densely pilose is now known to occur, and the variation seems unrelated to any other feature. Collections such as *Prescott 134* (NY), which include branches, seemingly identical otherwise, bearing two different pubescence-patterns on the calyces, demonstrate the insignificance of this character. It is also clear that variation within a rather wide range must be accepted for the calyx-teeth of *D. coerulea*, and this without known geographical or morphological correlation. On the other hand the majority of collections from south of Chachapoyas in Peru have larger flowers, thicker spikes, and ampler petals than prevail north of that point, and it is therefore possible to maintain a weakly characterized var. *longispicata*.

In Colombia the calyx-glands are only one or two in each interval, usually crowded below the middle or at very base of each membrane, and this pattern is repeated southward at least to the Equator, becoming however rarer toward the south. Sporadically in Colombia and then ever more commonly, each interval is charged with additional small glands set in a single (sometimes irregular) row extending into the base of the calyx-teeth. Southward the individual glands tend to become larger, but are not known to coalesce into the linear glands that characterize *D. ayavacensis*.

Key to the Varieties of *Dalea coerulea*

1. Flowers relatively small or of moderate size, the keel not over 10 (10.3) mm, its blades 4.8–5.8 mm long; *androecium* 7–10.5 mm long; Colombia and Ecuador, in n. Peru passing into the next. 77a. var. *coerulea*.
1. Flowers relatively large, the keel 10.2–12 mm, its blades 6–8.2 mm long; *androecium* 11.5–14 mm long; Peru. 77b. var. *longispicata*.

77a. Dalea coerulea (Linnaeus fil.) Schinz & Thellung var. coerulea (Plate LXXIX)

Spikes 3–12 (14) cm long, without petals mostly 11–15, rarely 17 mm diam; *inner petals* usually vivid dark blue, rarely purple (exceptionally white); *calyx-tube* either glabrous or pilose, glandular at base only or from base to apex, the teeth always pilose, in fruit plumose, the longest (dorsal) one 2.7–4.7 (5.5) mm long, when relatively long recurving in age and often obscurely hooked at tip. — Collections: 81 (o).

Páramos, rocky and brushy hillsides, and on cliffs and talus in canyons, sometimes becoming weedy in overgrazed pasture or in hedges, common and locally plentiful at 24---3450 m in the northern Andes, from n. Cordillera Oriental in Norte de Santander, Colombia, s. mostly e. of the Continental Divide through Ecuador into Amazonas (Chachapoyas), Peru, in Ecuador descending locally on dry cliffs and river-terraces to 1350–1800 m. — Flowering almost throughout the year. — *Representative*: COLOMBIA. Norte de Santander: *Schlim 299* (F). Santander: *Killip & Smith 18,007* (F, NY, US). Antioquia: *F. A. Barkley 18A175* (US). Boyacá: *Triana s. n.* (NY). Cundinamarca: *Pennell 2184* (NY, US), *2215* (F, NY, US). Narino: *Ewan 16,225* (IAN, US). Valle de Cauca: *Holton 14* (NY). Cauca: *Killip 6881* (NY). Putumayo: *Schultes & Cabrera 18,889* (NY, US). ECUADOR. Carchi: *Wiggins 10,663* (NY, UC, US). Imbabura: *A. S. Hitchcock 20,816* (NY, US). Pichincha: *J. N. & G. Rose 23,545* (F, NY, US); *Hartweg 955* (NY, OXF). Cotopaxi: *André s. n. in 1876* (NY). Tungurahua: *Pachano 118* (NY, US). Bolívar: *Acosta Solís 5892, 6835* (F). Chimborazo: *Rimbach 598* (F, NY). Cañar: *Camp 2777* (F, NY, US). Azuay: *Camp E-1881* (F, NY, US); *Maguire 61,687* (NY). PERU. Amazonas: Chachapoyas: *Hutchinson & Wright 4930* (F, NY, UC, US).

Dalea coerulea (Linn. f.) Schinz & Thell., Mém. Soc. neuchâtel. Sci. Nat. **5**: 370. 1913, based on *Galega coerulea* (blue) Linn. f., Suppl. 335. 1781. — "Habitat in America meridionali. *Mutis*." — Holotypus not examined, but the identity accepted since Kunth, l. c. infra. — *Tephrosia coerutea* (Linn. f.) Pers., Syn. Pl. **2**: 329. 1807. *Dalea mutisii* (José Celestino Mutis, 1732–1808) Kunth, Mimoses 161, tab. XLVII. 1819. *Parosela coerulea* (Linn. f.) Macbr., Contrib. Gray Herb., New Ser. **65**: 23. 1922.

Dalea astragalina (resembling some Astragalus) H. B. K., Nov. Gen. & Sp. (Folio) **6**: 484. 1823. — "Crescit prope Quito et in montosis Popayensium (Volcan de Purace), alt. 1500–1700 hex..." — Holotypus, *Humboldt & Bonpland 2012* from "Purace," P (herb. H. B. K.)! — *Parosela astragalina* (H. B. K.) Killip ex Macbr., Field Mus., Bot. **4**: 109. 1927.

This is the common bushy blue-flowered dalea of the northern Andes, collected repeatedly around Bogotá and Quito. In Colombia it is sympatric with *D. cuatrecasasii*, distinguished by deciduous bracts and short calyx-teeth, and southward from Mt. Chimborazo in Ecuador with *D. cylindrica* var. *nova*, of which the calyx-teeth are at once shorter and glabrate apically. Variation in pubescence of the calyx is a conspicuous feature of var. *coerulea*; see the description and discussion in foregoing paragraphs. Over the whole extent of its range, the epistemonous petals of var. *coerulea* are vivid ultramarine or cobalt blue which fades little in well-prepared specimens. An occasional albino mutant occurs (*André 683bis*, NY). At low elevations (down to 1350 m) in the gorge of Río Chanchán in Prov. Chimborazo, Ecuador (Huigra and vicinity, *J. N. & G. Rose 22,139*, NY, US; *Camp E-3009*, NY, UC, *E-3534*, F, NY, UC, US), the species is represented by a form with magenta-purple flowers. The stations for this form lie well below the normal limit (at ± 2400 m) of var. *coerulea*, but apart from the peculiar flower-color there seems to be nothing distinct about this valley race.

Macbride (1943) has already equated *D. coerulea* with *D. astragalina*. The name *D. mutisii* is a technical synonym of *Galega coerulea* although Kunth redescribed and figured new material collected by Humboldt and Bonpland near Bogotá (s. loc., herb. H. B. K., P!). Kunth thought that *D. astragalina* differed in its shorter spike and perhaps slightly more numerous leaflets, but the differences have lost all significance in the context of modern material.

77b. Dalea coerulea (Linnaeus fil.) Schinz & Thellung var. longispicata (Ulbrich) Barneby

(Plate LXXIX)

Spikes 4–14 cm long, 14–18 mm diam; *calyx-tube* glabrous or thinly pubescent externally, 2.9–3.7 mm long, the dorsal tooth 3–5.5 mm long, the glands in the intercostal membranes rather large, up to 0.3–0.8 mm long, not crowded below the middle of tube; *epistemonous petals* ultramarine blue. — Collections: 31 (o).

Habitats of var. *coerulea*, (1500) 1800–3200 m, locally abundant in inter-Andean valleys of n. and centr. Peru, especially on Río Marañón upstream from Amazonas (prov. Bongará and Chachapoyas) and the sources of Río Huallaga in Huánuco and Junín, thence s.-e., apparently rarer, to the Apurimac and Urubamba forks of Río Ucayali in Ayacucho and Cuzco, entirely e. of the Continental Divide except marginally near the crest in La Libertad (prov. Santiago de Chuco). — Flowering irregularly through the year. — *Representative*: Amazonas. Bongará: *Ferreyra & Acleto 15,166* (NY, US). Chachapoyas: *Wurdack 754* (F, NY, UC, US). Cajamarca. Celendín: *Ferreyra 15,099* (NY, US). Cutervo: *Ferreyra & Acleto 15,357* (NY, US); *Sandeman 4167* (K, OXF). La Libertad. Huamachuco: *López & Sagástegui 2799* (US). Bolívar: *López & Sagástegui 3283, 3303* (US). Santiago de Chuco: *Stork & Horton 9959* (F, US). Ancash. Huari: typus of *D. longispicata.* Huánuco. Huánuco: *Ferreyra 2120, 8158* (US); *Macbride & Featherstone 2085* (F, NY, US). Pachitea: *Macbride 3576* (F, US). Ambo: *Macbride & Featherstone 2427* (F, NY, US). Junín. Tarma: *Killip & Smith 22,219* (NY, US). La Mar: *Weberbauer 5570* (F, US). Cuzco. Urubamba: *Stafford 1062* (F, K); *Sandeman 3577* (OXF).

Dalea coerulea (Linn. f.) Schinz & Thell. var. **longispicata** (Ulbr.) Barneby, stat. nov., based on *Dalea longispicata* (long-spiked) Ulbr., Feddes Repert. **2**: 6. 1906. — "Peruvia: In Pichiu et Conin in Depart. Anchachs provinciae Huari 3500–3600 m. s. m. (A. Weberbauer, no. 2924, coll. 19 April 1903 spec. flor. et fruct.)." — Holotypus, formerly B, survives as *Field Neg. 2036*, F, NY, US!

Dalea macrostachya (large-spiked) Ruiz & Pavón ex Moricand, Pl. Nouv. Amér. 6 (in Mém. Soc. Genève **6**: 534), tab V. 1833. — "Habitat in Nova Hispania." — Holotypus, labelled "Nouvelle Espagne, M. Pavon, [misit] 1827," G! — *Parosela macrostachya* (Moric.) Rose, Contrib. U. S. Nat. Herb. **12**: 273. 1909. Non *P. macrostachya* sensu Rydb., N. Amer. Fl. **24**: 110. 1920, quae = *D. lutea* (Cav.) Willd.

In *Flora of Peru* Macbride (1943) reduced *D. longispicata* to *D. coerulea*, of which it seems indeed to be hardly more than a large-flowered expression, but this coinciding with a dispersal pattern that lends it some taxonomic significance. There is a critical area in Amazonas, Peru, where material can be sorted artificially by size of keel-petals; elsewhere the vars. *coerulea* and *longispicata* are readily distinguished. One collections from Junín, *Killip & Smith 24,333*, is almost var. *coerulea* although found in the same locality as var. *longispicata* (*no. 24,289*, F); it is interpreted as a minor variant.

With the exception of the much rarer *D. ayavacensis*, this is the only shrubby Peruvian dalea with large blue flowers coinciding with aristiform calyx-teeth longer than the tube. It was collected first in the 1789s by Ruiz and Pavón (F), the exact locality not recorded.

The typus of *D. macrostachya*, supposedly collected in New Spain, i.e. in Mexico or possibly Guatemala, is characteristic Peruvian var. *longispicata*. The mistake about its origin must be attributed not to Moricand, but to Pavón, who distributed the specimen accompanied by his usual terse label bearing the legend "*Dalea macrostachya*. N.E." Pavón, of course, was never in Mexico, but had access to the herbaria collected there by Sessé and collaborators, and sent many of these to Moricand and other correspondents abroad. In 1827, when Moricand received this Dalea, Pavón was nearly seventy, harassed by debt, and selling miscellaneous packets of plants from the New World, without any precise data as to their origin. While the collector of *D. macrostachya* cannot now be known with any certainty, it seems not unlikely that the specimen is a duplicate of the Pavón specimen at Field Museum, mentioned in the preceding paragraph.

78. Dalea ayavacensis Humboldt, Bonpland & Kunth
(Plate LXXX)

Bushy when mature and up to 1.5 m tall or perhaps more, sometimes flowering precociously as a coarse, suffrutescent, monopodial herb ± 1 m tall, paniculately branching distally, the young stems and often the foliage densely silky-pilosulous with fine antrorsely ascending and spreading hairs up to 0.4–0.9 mm long, the foliage at first silvery-cinereous but becoming (or sometimes from the first) greenish-cinereous or green, the leaflets equally pubescent both sides or glabrescent to glabrous above, punctate beneath; *leaf-spurs* 1–2 mm long; *stipules* linear-subulate, stiff, densely pilosulous, 4.5–8.5 mm long; *intrapetiolular glands* 2, spiculiform; *post-petiolular glands* small, often concealed by vesture; *leaves* shortly petioled, the main cauline ones 3–7 cm long, with stiff, narrowly margined rachis and (4) 5–8 (9) pairs of oblong-elliptic to broadly oblong-oblanceolate, obtuse or subacute, gland-mucronulate, dorsally keeled leaflets 5–15 mm long; *spikes* mostly terminal to leafy branchlets, sessile or shortly pedunculate (peduncles up to 1.5–3 cm long), ovoid early becoming cylindric, densely many-flowered but not conelike, including bract-tails 12–22 mm diam, the densely pilosulous axis finally 3–12 cm long; *bracts* persistent, the ovate-oblong, navicular body 3–4 mm long, narrowly membranous-margined, either pubescent or glabrous dorsally, contracted into a tail 1–9 mm long; *calyx* 4.7–8 mm long, the glabrous, rarely thinly pilosulous, vernicose tube 2.2–2.8 mm long, subsymmetric at orifice, the slender but prominulous ribs brown or yellowish, the membranous intervals charged along either side, parallel with the ribs, with a linear, orange gland extending from near base to the sinuses, the triangular-aristate teeth a little unequal, the dorsal one (2.5) 3.9–5.5 mm long (0.3–3 mm longer than tube), all plumose-ciliate with spreading hairs up to ± 1–1.6 mm long, when long stellately spreading and flexuous in age; *petals* ± bicolored, the banner opening whitish with green eye-spot, rubescent, gland-tipped and -sprinkled, the epistemonous ones perched low on the androecium, (1) 1.1–2.8 mm above hypanthium, either pale blue or vivid cobalt blue, the keel gland-tipped; *banner* 5–7 mm long, the claw 2–3.4 mm, the broadly ovate-cordate, hooded blade open at base, either glabrous or obscurely puberulent dorsally above claw, 3.1–5 mm long, 3–5.6 mm wide; *wings* 4–6.3 mm long, the claw 1.4–2.6 mm, the blades 2.7–4 mm long, 1.3–1.9 mm wide; *keel* 5–8.8 mm long, the claws 1.9–3.4 mm, the ovate-elliptic blades 3.4–6 mm long, 1.7–3.2 mm wide; *androe-*

cium 10-merous 5–10.5 mm long, the longer filaments free for 1.6–2.5 mm, the connective gland-tipped, the anthers 0.45–0.6 mm long; *pod* (scarcely known) apparently as in *D. coerulea*.

My concept of this rare but evidently polymorphic species is so drawn as to include all those Peruvian and Ecuadorean daleas that resemble *D. coerulea* in habit and in the long-toothed calyx externally glabrous and lustrous or thinly pilose up to the plumose orifice, but differ in one characteristic feature of the calyx. In all forms of *D. coerulea* the glands of the intercostal calyx-membranes, of whatever size and however few or many they may be, are relatively small, elliptic or circular in outline, and situated in one vertical row occupying the middle of each panel. In *D. ayavacensis* the glands of each interval are two or sometimes three, elongately linear, at least the two lateral ones aligned vertically along each side of the panel adjacent to the ribs. With a calyx of this type there is correlated (with one exception) a long-caudate type of interfloral bract which imparts to the flower-spike a teasel-like aspect not seen in *D. coerulea*. The still scanty material of *D. ayavacensis*, as defined by the peculiar calyx, shows a dismaying variability in pubescence of the foliage and particularly in size of flower and length of androecium. This is the more difficult to interpret due to ignorance of its scope both within and between populations and lack of data on patterns of dispersal. The recognition of three varieties proposed herein is obviously provisional, but seems justified, even required, at the level of information attained.

Key to the Varieties of *Dalea ayavacensis*

1. Bracts at once long-tailed and dorsally pubescent, the flexuously or sigmoidally spreading tail 4–9 mm long; *calyx-teeth* to 4–5.5 mm long.
   2. Flower large, the vivid blue keel-blades 4.5–6 mm long, 2.8–3.2 mm wide; *androecium* 8.5–10.5 mm long; known range notably bicentric, extreme s. Ecuador and adjoining Peru, and also far s. in Cuzco and Apurimac, Peru. 78a. var. *ayavacensis*.
   2. Flower small, the pallid blue keel-blades 3.4–3.6 mm long, 1.8–2.2 mm wide; *androecium* 5–6 mm long; s. Ecuador. 78b. var. *killipii*.
1. Bracts at once short-tailed and dorsally glabrous, the tail straight, 1–2.5 mm long; *calyx-teeth* to 2.5 mm long. Flower as in var. *killipii*, the keel-blades ± 3.4 mm, the androecium ± 6 mm long; n. Peru (Cajamarca). 78c. var. *viridescens*.

78a. Dalea ayavacensis Humboldt, Bonpland & Kunth var. ayavacensis

(Plate LXXX)

Foliage green or becoming so, the young leaves often silvery both sides, the adult primary ones (sometimes all) glabrate or glabrous above; *spikes* (2) 3–8 cm long, including bracts 13.5–22 mm diam; *calyx-tube* either glabrous or more rarely thinly pilose, the plumose teeth up to 4–5.5 mm long. — Collections: 5 (o).

Habitat unknown, but to be expected on dry brushy hillsides or canyon terraces at ± 2250–2800 m, known from two remotely separate areas in the Andes of s. Ecuador and Peru: extreme n. Peru and adjoining Ecuador, on or near the Pacific slope; and on upper Río Apurimac in Cuzco and adjoining Apurimac, Peru. — Flowering May to

August, perhaps later. — *Material*: ECUADOR. LOXA: Loxa, *Hartweg 727* (F, NY, OXF); *Seemann 754* (K). PERU. PIURA. Ayabaca: Ayabaca, *typus*. APURIMAC. Abancay: Tranacapala, *Univ. Cuzco 1264* (F). CUZCO. Anta: Cuzco to Abancay, *Rauh-Hirsh P 1680* (NY).

Dalea ayavacensis (of Ayabaca) H. B. K., Nov. Gen. & Sp. (Folio) **6**: 486. 1823. — "Crescit prope Ayavacam Peruvianorum inter Loxam et Guancabambam, alt. 1407 hex..." — Holotypus, *Humboldt & Bonpland 3483*, P (herb. H. B. K.)! — *Parosela ayavacensis* (H. B. K.) Macbr., Field Mus., Bot. **4**: 86. 1925.

The apparent bicentric dispersal of var. *ayavacensis* is unexplained, but there seems to be no difference between the plants collected by Hartweg in Ecuador and the two cited from upper Apurimac valley. Because other known forms of *D. ayavacensis* sens. lat. are concentrated in northern Peru and adjoining Ecuador it is possible that the southern populations are adventive. In the early stages of my study, before the close kinship of *D. ayavacensis* and *D. killippi* had been appreciated, I interpreted the former as a variety of *D. coerulea*, of which it has nearly the foliage and flower, thinking that the characteristic linear calyx-glands might have arisen independently in the two areas from sympatric strains of *D. coerulea* var. *longispicata*. This, however, would not account for the long-tailed bracts common to var. *ayavacensis* and var. *killippi*, but not known in *D. coerulea*.

Macbride (1927, p. 102, 111) at first distinguished *Parosela ayavacensis* from *P. astragalina* (= our *D. coerulea*) by a supposedly thicker flower-spike, but his concept excluded (as he already suspected) the genuine *D. ayavacensis* of Humboldt, being the equivalent of our *D. coerulea longispicata*. Subsequently (1943), finding the broad spike no longer significant, Macbride reduced all these names to the synonymy of *D. coerulea*. It thus happened that *D. ayavacensis* was lost sight of, and its peculiar calyx overlooked.

78b. DALEA AYAVACENSIS Humboldt, Bonpland & Kunth var. KILLIPII (Macbride) Barneby

(Plate LXXX)

Foliage silvery, apparently permanently, the leaflets densely silky-pilose both sides; *spikes* 16–19 mm diam, becoming 4–12 cm long; *calyx-tube* glabrous externally, the plumose teeth up to 3.9–4.2 mm long. — Collections: 2 (o).

Habitat not recorded, but to be sought in brushy places near 2500 m, known only from the Andes of s. Ecuador in Cuenca and Azuay. — Flowering July to September. — *Material*: CUENCA: *typus*. AZUAY: eastern Cordillera n. of village Sevilla de Oro, *Camp E-4551* (F, K, NY, UC, US).

Dalea ayavacensis H. B. K. var. **killipii** (Macbr.) Barneby, stat. nov., based on *Parosela killipii* (Ellsworth Paine Killip, 1890–19) Macbr., Field Mus., Bot. **4**: 110. 1927 ("*Killippii*"). — "ECUADOR: vicinity of Nabón, Sept. 26, 1918, *Rose, Pachano & Rose 23033*..." — Holotypus, US! isotypi, GH, NY! — *Dalea killipii* (Macbr.) Macbr., Candollea **7**: 223. 1937.

A handsome dalea, notable for the silvery foliage and long narrow spikes of flowers alternating with sigmoidally spreading, teasel-like bracts. The pubescence is matched on younger leaves of var. *ayavacensis* collected at Loxa by Hartweg, but the adult leaves of the latter are green. The small flower, and especially the short androecium, are the only real differential characters, but the petals (at least of *Camp E-4551*) appear to have been pale milky blue, not the vivid blue or violet-blue of var. *ayavacensis*. According to Camp the plants in Azuay were flowering as erect herbs with a single stem rising from yellow

roots and branching distally into more or less flat-topped panicle of spikes. These, however, were doubtless juvenile individuals, due to become bushy and suffruticose in age.

78c. Dalea ayavacensis Humboldt, Bonpland & Kunth var. viridescens Barneby (Plate LXXX)

Foliage green, the leaflets glabrous to thinly pilosulous above; *spikes,* due to the short bracts, only 12–13 mm diam; *calyx* 4.7 mm long, the tube 2.2 mm, the dorsal tooth 2.5 mm long; *keel* 5 mm long, the claws 1.9 mm, the blades 3.4 mm long, 2.2 mm wide; *androecium* 6.2 mm long, the longer filaments free for 2 mm. — Collections: 1 (typus).

Habitat not recorded, known only from the type-locality on a small affluent of Río Marañón, at 1500 m, in s. Jaén, Dept. Cajamarca, Peru. — Flowering in June.

Dalea ayavacensis var. **viridescens** (growing green, of the glabrate foliage) Barneby, var. nov., a var. *killipii*, cum qua floribus parvulis congruit, foliis parce pilosulis viridibus, bracteis praeter imas dorso glabris in caudam breviter subulatam 1–2.5 mm tantum longam abeuntibus, dentibus calycinis abbreviatis dorsali ± 2.5 (nec 4–5.5) mm longo, a var. *ayavacensi*, quoad pubem simili, carinae laminis parvis pallide coerulescentibus ± 3.4 (nec 4.5–6) mm, androecioque ± 6.2 (nec 8.5–10.5) mm longis ulterius distans. — PERU. Cajamarca. Jaén: Colasay, 1500 m, June, 1963, *Felix Woytkowski 8016.* — Holotypus, US! isotypus, K!

A peculiar plant, resembling var. *ayavacensis* in its thinly pubescent leaves and var. *killipii* in its small corolla and short androecium, but different from all other known forms of *D. ayavacensis* in the shorter tails of the dorsally bald bracts and the substantially shorter calyx-teeth, the dorsal one only a trifle (and not 1–2.5 times) as long as the tube. Before I had appreciated the relationship of *D. killipii* to *D. ayavacensis* I interpreted var. *viridescens* as a variety of the former, of which it has the small, milky-blue petals, short androecium, and linear calyx glands.

79. Dalea cuatrecasasii Barneby (Plate LXXVIII)

Suffruticose, irregularly branching, becoming bushy up to 1.2 m tall, pilosulous almost throughout with ascending or weakly spreading hairs up to 0.2–0.5 mm long, the stramineous or purplish, distally verrucose stems when young like the young foliage silky, the fully expanded leaves becoming green, the leaflets pubescent both sides or only beneath, punctate; *leaf-spurs* 0.4–1.2 mm long; *stipules* subulate, green or livid, 1–3 mm long, pilosulous dorsally; *intrapetiolular glands* 2, small; *post-petiolular glands* prominent, conic or rounded; *leaves* shortly petioled or subsessile, the main cauline ones (2) 2.5–6 cm long, with margined, openly grooved rachis and 4–7 pairs of oblong-elliptic or -oblanceolate and apiculate, or short-acuminate to obovate and emarginate, flat or loosely folded, dorsally keeled leaflets 5–16 mm long; *peduncles* both leaf-opposed and terminal to branchlets, (0.7) 1–6.5 (10) cm long; *spikes* dense but not conelike, ovoid becoming oblong-cylindroid, without petals or androecia 10–12 mm diam, the densely pilosulous axis becoming 1–8 cm long; *bracts* deciduous, sometimes (especially the lowest) tardily, 2.5–5.5 mm long, the lowest ovate-acuminate, the longer and narrower interfloral ones lance-acuminate or -caudate, the lowest

firm and pilosulous overall externally, pubescent within only at tip, the rest thin-margined in lower half, becoming firm upward, at tip green or livid, pilosulous; *calyx* 4.6–6.4 mm long, densely pilosulous with ascending hairs up to 0.4–0.7 mm long, the tube 2.6–4.1 mm long, a little recessed behind banner, the slender, often castaneous ribs becoming prominent, the membranous intervals charged with 1 row of 2–4 (5) small yellow glands concealed by vesture, the green or green-tipped, gland-tipped and minutely gland-spurred teeth unequal, the dorsal one 2–3.2 mm long (0–1.6 mm shorter than tube), triangular-subulate, the rest similar but broader-based and shorter, the tips of all often a trifle incurved; *petals* bicolored, the banner whitish, sometimes with colored corners, rubescent, sprinkled with large glands, glabrous dorsally, the epistemonous ones lavender- or pink-purple, perched low on androecium (± 1.8–2.2 mm above hypanthium), the keel and banner either gland-tipped or not; *banner* 5–6.5 mm long, the claw 2.2–4 mm, the suborbicular-cordate blade 3.4–5 mm long, 4–5.8 mm wide, deeply emarginate at apex, recessed at base into a shallow cornet; *wings* 6.1–7.3 mm long, the claw 1.8–2.6 mm, the oblanceolate-obovate blade 4.8–5.6 mm long, 2.5–3.3 mm wide; *keel* 8.4–10 mm long, the claws 3.2–4.1 mm, the obovate-elliptic blades 5.8–6.4 mm long, 3.3–3.5 mm wide; *androecium* 10-merous, 9–12.5 mm long, the longer filaments free for 3–3.7 mm, the connective gland-tipped, the anthers 0.6–0.75 mm long; *pod* triangular in profile, 2.6–3 mm long, the style-base latero-terminal, the valves rather firm, glabrous at base, thence pilosulous and gland-sprinkled; *seed* ± 2 mm long. — Collections: 15 (o).

Brushy hillsides, edge of thickets, sometimes in hedges, 1800–2700 m, apparently not uncommon in Cordillera Oriental of Colombia, from Norte de Santander (near Pamplona) s. to n. Cundinamarca (near Ubate), in lat. 5° 20′–7° 30′ N. — Flowering intermittently through the year. — *Representative*: NORTE DE SANTANDER: *Alston 7114* (F, US); *Garganta 1045* (F, US). SANTANDER: *Killip & Smith 16,837* (F, NY, US), *19,504* (F, NY). BOYACÁ: *Fosberg 22,182* (NY, US); *Cuatrecasas 1099* (US, ± topotypus), *1833, 1868* (F); *Mason 13,720* (UC). CUNDINAMARCA: *Koeie 4525* (C, US); *Haught 6169* (US).

Dalea cuatrecasasii (José Cuatrecasas, 1903–) Barneby, sp. nov., a *D. coerulea* (L. f.) Schinz & Thell. imprimis calyce brevidentato ab ipso basi dense pilosulo, vexillo dorso glaberrimo, petalisque roseopurpureis nec saturate azureis absimilis. — Suffrutices demum dumosae 1.2 m usque altae, fere undique pilosulae, foliis adultis viridibus; *folia* majora 2.5–6 cm longa, foliolis 4–7-jugis majusculis 5–16 mm longis; *spicae* pedunculatae densae, corolla ablata 10–12 mm diam, axi 1–8 cm longo; *bracteae* interflorales deciduae; *calyx* 4.6–6.4 mm longus, tubo 2.6–4.1 mm, dente dorsali (longiori) 2–3.2 mm longis; *petala* bicoloria, vexillo albido rubescenti, epistemoneis roseo-purpureis, carinae laminis 5.8–6.4 mm longis. — COLOMBIA. BOYACÁ: Soatá, 2130 m, sept 6, 1938, *J. Cuatrecasas 1005*. — Holotypus, US; isotypus, F.

In habit and foliage *D. cuatrecasasii* resembles and has often been mistaken for *D. coerulea*, but is easily distinguished by the calyx, at once densely pilosulous from base upward and short-toothed, accompanied by a dorsally glabrous banner. In *D. coerulea* the bracts are thrown off tardily if at all, in *D. cuatrecasasii* before the petals expand. Typical *D. coerulea* extends northward through Cordillera Oriental, but nowhere north of Bogotá abundantly, as far as Santander, and the two species were collected close together near Surata by Killip & Smith (*nos. 16,837, 18007*). In this region they are abruptly distinct in the characters mentioned, as well as in flower color, the epistemonous petals of *D. coerulea* being vivid cobalt blue, those of *D. cuatrecasasii* rose or purple. The purple-tipped androecium of the latter is not absolutely longer than that of *D. coerulea* but relative to the calyx is much more so, becoming a conspicuous feature of the spike as the petals fall.

Like many Andean daleas, *D. cuatrecasasii* occurs in greener, glabrescent and grayer, silky-pubescent phases. Killip used two unpublished names to distinguish them, one of which, honoring the eminent Colombian botanist José Cuatrecasas, is here taken up with particular pleasure. The species was collected first in 1842 or 1843 by Jean Jules Linden (*no. 1324*, NY, OXF, W).

80. DALEA CYLINDRICA Hooker
(Plates LXXXI, LXXXII)

Herbs and subshrubs, variable in habit and pubescence, often diffuse (rarely radicant) when young or in exposed places, becoming when favored or aged erect and bushy, pilosulous at least on the young stems, sometimes densely villous nearly throughout, the foliage green to silvery-pilosulous, the leaflets glabrous or pubescent above, punctate beneath, the mature stems usually castaneous, densely microtuberculate to almost smooth; *leaf-spurs* 0.5–1.8 mm long; *stipules* narrowly lance-caudate to linear-setiform, (0.6) 1–7 mm long, pilosulous dorsally from base upward or only at tip; *intrapetiolular glands* small, rounded or spiculiform; *post-petiolular glands* small but prominent, blunt or conical; *leaves* shortly petioled or subsessile, the main cauline ones (1.5) 2–5.5 cm long, with slender, narrowly margined rachis and 4–10 (11) pairs of oblong-elliptic to obovate, obtuse, obtuse and gland-mucronate, or very shortly acuminate, dorsally keeled, mostly flat, sometimes loosely folded leaflets (1.5) 2–15 (17) mm long, the leaves of spurs (sometimes the only leaves present at anthesis) smaller, with ± 3–6 shorter, often more densely pubescent leaflets; *peduncles* except the first of each primary axis terminal to leafy branchlets, (1) 1.5–13 cm long, the spikes mostly elevated well above the foliage; *spikes* moderately dense, ovoid or the larger ones quickly becoming oblong-cylindroid, without petals or androecia (9) 10–12 (14) mm diam, the pilosulous, rarely glabrescent axis 1–16 cm long; *bracts* persistent, commonly glabrous externally except for the keel and tail, rarely pilosulous nearly throughout, the navicular body 2–3.5 (4) mm long, in profile (0.9) 1–1.4 (1.5) mm wide, livid or castaneous within the membranous margins, sparsely to densely gland-sprinkled, contracted gradually or abruptly into a straight or ± recurved, puberulent tail (0.4) 1–3 mm long; *calyx* (4) 4.2–6 (6.2) mm long, the tube externally either glabrous or thinly pilose, throughout or at base only, with fine, straight, spreading-ascending hairs up to 0.5–1.5 mm long, the tube (2.8) 3–3.8 mm long, oblique at the internally ciliolate orifice but not strongly recessed behind banner, the ribs castaneous or livid, slender or sometimes stout from the beginning, the membranous intervals charged with 1 row of 3–7 yellow or livid glands, the deltate, triangular, or triangular and short-acuminate teeth unequal, the dorsal one longest, 1.2–2.7 (3) mm long, at least 0.2 mm shorter than tube; *petals* variably colored, the epistemonous ones commonly purple or blue or partly so, more rarely all sulfur-yellow, the banner and keel often but not always gland-tipped, the banner nearly always gland-sprinkled, glabrous dorsally, the epistemonous petals perched ± 1.6–3 mm above hypanthium; *banner* (5.5) 6–9.2 mm long, the claw 2.3–4.2 mm, the broadly ovate-cordate, obtuse, hooded blade (4) 4.3–5.5 mm long, (3.6) 4.2–5.6 mm wide, open at base but the basal lobes incurved and often ± adherent; *wings* 4.8–8 mm long, the claw 1.3–2.3 mm, the obovate blade 3.2–6.4 mm long, 1.6–3.7 mm wide; *keel* (6.2) 6.8–10.7 mm long, the claw 1.5–3.2 mm, the amply ovate-elliptic blades (4.3) 4.7–8 mm long, (2.7) 3–5.1 mm wide; *androecium* 10-merous, (7.2) 8–12 mm long, the longer filaments free for (2) 2.4–4.5 mm, the connective gland-tipped, the anthers (0.55) 0.6–1.05 mm

long; *pod* (little known) broadly deltate-obovate in profile, 2.6–3.2 mm long, the style-base near corner, the prow slenderly keeled, the valves membranous and glabrous below middle, distally pilosulous and gland-sprinkled.

The series of daleas assembled here into an inclusive and polymorphic *D. cylindrica* present some of the more difficult taxonomic problems in the genus. Parts of the complex were referred by Macbride (1943) to six species: *D. nova, D. sawadae, D. catatona, D. sulfurea, D. rubricaulis*, and *D. cylindrica* sens. str. (including a variety); but the features of these that were supposed to be diagnostic are all highly variable, and the material that has accrued in the past 25 years fits ill or not at all into the scheme proposed in *Flora of Peru*. Characters common to all aspects of *D. cylindrica* as redefined above are: persistent bracts, which may be, however, either glabrous or pubescent dorsally; short-toothed calyx, tending to be glabrous externally or at least glabrescent in the teeth; and relatively big flowers arranged in moderately dense spikes. In the last analysis, it is a disjunct range rather than morphological differences which permit the segregation of *D. pazensis*, and deciduous bracts alone exclude from the *D. cylindrica* complex the closely related *D. onobrychis, D. Smithii, D. pennellii,* and *D. azurea*.

The most unstable features within *D. cylindrica* are: stature; density and length of leaf-pubescence; leaf-size and to some degree number of leaflets, this to be compared only between leaves of the same age and order; and color of the petals and calyx-glands. No one character by itself serves to distinguish any segment of the complex, but groups of two or more characters are clearly emphasized within natural geographic ranges. Even within the varieties of *D. cylindrica* recognized below, the same sort of variation, though in less extreme form, is encountered with such frequency that one might almost say that no two populations of the species are exactly alike. Disregarding for the moment the crucial exceptions mentioned later on, one can recognize a major dichotomy in *D. cylindrica* corresponding to a cismontane and an intermontane series. The former, including *D. cylindrica* sens. str., has usually few, large, and thin leaflets; a calyx-tube very often glabrous externally, and charged with relatively large, black or livid glands; and petals either pale yellow, or pale yellow tinged with purple, or if purple of a reddish-amethystine hue. In the latter, which extends south in Peru to Junín and north through Amazonas into Ecuador, the petals are always of some shade of blue of blue-violet, usually the vivid cobalt seen in sympatric forms of *D. coerulea*. These intermontane populations, from which were derived the types of *D. nova, D. sawadae, D. cutervoana, D. catatona* are internally diverse and separable into two major categories, corresponding with var. *nova* and var. *haenkeana* as defined in the following pages. In central Peru the two primary divisions of *D. cylindrica* are geographically disjunct, sharply separated by the westernmost crest of the Andes, but the separation further north becomes imperfect and there is a critical area of intergradation on the Pacific-Marañón watershed between southern Cajamarca and Ancash. In northern Ancash var. *cylindrica* is represented by a race that combines the foliage and calyx of the cismontane series with the blue petals of var. *nova*. Also common, perhaps dominant in the same region is a slender form distinct in its diminished foliage, short spikes, usually diffuse or prostrate habit. This is recognized below as *D. cylindrica* var. *haenkeana*, but intergrades freely in Cajamarca with var. *nova*. In nearly the same latitudes on the Pacific slope in Cajamarca and La Libertad the picture is complicated by the appearance of a dalea with pale-yellow petals combined with densely and loosely pilose foliage, but otherwise hardly different from some individual races of var. *cylindrica*. It is maintained, for the sake of convenience, as *D. cylindrica* var. *sulfurea*. The closely related *D. fieldii*, found near the southern limit of var. *nova* in Huánuco, combines in an interesting and suggestive manner the few ample leaflets of var. *cylindrica* with the blue petals of var. *nova*, but introduces its own variation on the theme of pubescence combined with longer, narrower, finally deciduous bracts. Its status as a distinct species is open to reinterpretation.

Key to the Varieties of *Dalea cylindrica*

1. Epistemonous petals blue, amethyst-purple, or largely sulfur-yellow, but if the latter at least the keel purple-tipped or -tinged (or becoming so in age) and the foliage only thinly shortly pilosulous; *foliage* sometimes gray-silky in youth, but the mature leaflets green, commonly glabrous above, the longest hairs beneath not over 0.5 mm long.
   2. Leaflets of main cauline leaves (or some of them) 6–15 mm long; stipules 2.5–7 mm long.
      3. Calyx-tube glabrous or thinly pilose above middle, the orifice often densely ciliate, the teeth commonly glabrate distally, not corneous-margined; *petals* opening pale yellow, or pale yellow tinged with amethyst, or all reddish-purple, more rarely (in Ancash) blue, but the *leaflets* of main cauline leaves in any case 4–7 pairs (of spurs only 3–4 pairs); cismontane Peru, from Arequipa to Cajamarca, passing n.-ward into var. *nova*. 80a. var. *cylindrica*.
      3. Calyx-tube normally pilose from base to orifice, the pubescence thence thinner upward along the teeth, these in age rigid and corneous-margined, the tip of the dorsal one extending above the longest hairs; *leaflets* of main cauline leaves 6–10 (11) pairs (of spurs 3–6 pairs); intermontane Peru, from Junín n.-ward into s. Ecuador, but extending shortly w. of the Divide in Cajamarca and La Libertad, and there confluent with var. *cylindrica* and var. *haenkeana*. 80d. var. *nova*.
   2. Leaflets of main cauline leaves 2–5 (6) mm long; *stipules* 1–3.5 mm long. Spikes mostly short, the first of each primary axis ± 1–3 (3.5) cm long, sometimes reduced to less than 10 flowers; *petals* blue (perhaps sometimes amethyst-purple); centr. and n. Peru. 80c. var. *haenkeana*.
1. Epistemonous petals opening and remaining sulfur-yellow; foliage densely silky-pilosulous with spreading-ascending hairs up to 0.6–1 mm long; cismontane in Cajamarca and on both slopes in La Libertad. 80b. var. *sulfurea*.

80a. DALEA CYLINDRICA Hooker var. CYLINDRICA

(Plate LXXXI)

Stems at first slender and diffuse, sometimes suffruticose and ascending or erect in age, up to 7–10 dm long, minutely and distantly verruculose; *primary leaves* 2–5.5 cm long, the leaflets mostly 6–15 mm long, often glabrous above but not always so; *calyx-tube* glabrous or thinly pilose, the glands of intercostal membranes mostly livid or blackish; *banner* opening cream-colored, sometimes with purple basal lobes, rubescent; *epistemonous petals* varying from ochroleucous or pale yellowish fading purplish in inner half to bright reddish-purple except for pale exterior margins; *spikes* terminal to primary cauline axes mostly 3–8 cm long. — Collections: 26 (o).

Open rocky slopes, 800–3550 but mostly above 1700 m, apparently local along the Pacific slope of the Peruvian Andes from Moquegua to s.-w. Cajamarca (Contumazá). — Flowering November to June. — *Representative*: CAJAMARCA. Contumazá: *López, Sagástegui & Sánchez 3673* (US). ANCASH. Bolognesi: *Ferreyra 5625, 5637, 5700, 7330* (US). Yungay: typus of *D. samancoënsis*. LIMA. Canta: *Pennell 14,549* (F, K, NY, US). Huarochirí: *Goodspeed & Weberbauer 33,054* (UC, US). AYACUCHO. Lucanas: *Ferreyra 5484* (US), *7182* (F, US). Parinacochas: *Weberbauer 5798*

(F, US). AREQUIPA. Condesuyos: *Stafford 1209* (F, K). Arequipa: *Pennell 13,153* (F, NY), *13,155* (F, K, NY, US); *Sandeman 3770B* (K, OXF). Caravelí: *Ferreyra 13,433* (REGINA). MOQUEGUA. Mariscal Nieto: *Weberbauer 7291* (F).

Dalea cylindrica (cylindrical, of the spikes) Hook., Bot. Misc. **2**: 213. 1831. — "Valley of Canta." — Holotypus, collected by Alexander Cruckshanks, K (herb. Hook.)! — *Parosela cylindrica* (Hook.) Macbr., Contrib. Gray Herb., New Ser. **65**: 23. 1922.

Dalea samancoënsis Ulbr., Feddes Repert. **2**: 8. 1906. — "Peruvia: inter Samanco et Caraz infra Haciendam Cajabambam in departimento Ancachs, 3000–3500 m (A. Weberbauer legit 27. V. 1903...no. 3136)." — Holotypus, formerly B, survives as *Field Neg. 2039*, F + fragm. clastotyp., NY, US! — *D. cylindrica* var. *samancoënsis* (Ulbr.) Macbr., Field Mus., Bot. **13**[3]: 368. 1943.

Dalea calocalyx (with beautiful calyx) Ulbr., Feddes Repert. **2**: 10. 1906. — "Peruvia: Ad viam ferream a Lima ad Owyam: in valle Huillacachi procul Matucana...2370–3000 m (A. Weberbauer...28 decemb. 1901)." — Holotypus, formerly B, survives as *Field Neg. 2033*, F + fragm. clastotyp., NY, US! — *Parosela calocalyx* (Ulbr.) Macbr. Field Mus., Bot. **4**: 104. 1927.

Parosela rubricaulis (red-stemmed) Rusby, Bull. N. Y. Bot. Gard. **6**: 511. 1910. — "Arequipa, 7500 ft., Aug. 8, 1901 (No. 2523)." — Holotypus, collected by R. S. Williams, NY! isotypi, K, US! — Non *Dalea rubricaulis* Ulbr., 1915.

My definition of var. *cylindrica* admits considerable variation in pubescence of stems and leaves, but the hairs are always short and subappressed. The ample material from Canta shows that the nomenclatural type belongs to a diffuse or prostrate phase with green leaves and externally glabrous calyx. The flowers from this province are either bicolored from the beginning. or open sulfur-yellow and turn more or less purple in age, a sequence particularly noted by Pennell on Río Chillón above Obrajillo. The description and phototypus of *D. calocalyx* agree closely with topotypical *D. cylindrica*; according to Macbride the calyx varied from glabrous to pilose, and there is one example of a hairy calyx in the clastotypus cited. The material from Arequipa, likewise extensive, differs in its more erect and perhaps taller stature and uniformly purple epistemonous petals. In the early stages of this study I thought this might be distinguished taxonomically, but collections from Ayacucho seen subsequently have dispelled the notion. The plants from Ancash and Cajamarca with externally pubescent calyx and purple epistemonous petals combined (but not constantly) with silky-pubescent leaflets correspond more or less closely with var. *samancoënsis* (Ulbr.) Macbr., treated here as a minor variant but of interest because it suggests passage into the more northern and more pubescent var. *sulfurea*. It is a measure of the difficulties encountered when a group of plants has not been revised methodically that Ulbrich compared his *D. calocalyx* with the Mexican *D. tuberculata* and his *D. samancoënsis* with the Mexican *D. mutabilis*, but neither of them with the sympatric *D. cylindrica*, his diagnoses being technically sound but, due to lack of proper context, essentially irrelevant.

80b. DALEA CYLINDRICA Hooker var. SULFUREA (Ulbrich) Barneby

Habitally similar to the more diffuse phases of var. *cylindrica*, but pubescent throughout with longer hairs; *primary leaves* mostly 2–3 cm long, the leaflets mostly 5–10 mm long; *calyx-tube* either glabrous externally except for a few long hairs near base, or finely pilosulous all over, the orifice ciliate, the teeth pilose within, sometimes glabrous without; *petals* all permanently sulfur-yellow. — Collections: 3 (o).

Dry or (seasonally) moist hillsides, 2130–2400 m, apparently local, known only from the Pacific slope of the Peruvian Andes in s. Cajamarca and La Libertad, and (perhaps in a distinct phase) inland in the latter Department to the upper Marañón valley in province Pataz (Huaylillas to Tayabamba). — Flowering May and June, doubtless later. — *Material*: CAJAMARCA. Hualgayoc: phototypus. LA LIBERTAD. Otuzco: *López, Sagástegui & Sánchez 3673* (US). Pataz: *López & Sagástegui 3418* (US).

Dalea cylindrica Hood var. **sulfurea** (Ulbr.) Barneby, stat. nov., based on *D. sulfurea* (sulfur-yellow, of the petals) Ulbr., Feddes Repert. **2**: 5. 1906. — "Peruvia: Infra San Miguel in Departimento Cajamarca Hualgayocae provinciae...(A. Weberbauer legit 5. Maio 1904.. .no. 3922)." — Holotypus, formerly B, survives as *Field Neg. 735*, F, NY, US! — *Parosela sulfurea* (Ulbr.) Macbr., Field Mus., Bot. **4**: 104. 1927.

The typus of *D. sulfurea* was collected at early anthesis and the spikes are therefore atypically short, the axis not much over 1 cm long. The lack of anthocyanin in the petals combined with loosely pubescent foliage are the weak differential characters on which I maintain the entity as distinct. The pubescence is certainly longer than in any known phase of var. *cylindrica*, but only a trifle denser. The collection from the transmontane slope in La Libertad has the long spike of var. *cylindrica*, the yellow petals of var. *sulfurea*, but a calyx pubescent externally from base upward. The material is as yet too scanty to reveal the full range of variation and the present disposition of what we do have is inevitably provisional. The affinity of *D. sulfurea* was not at all understood by Ulbrich, who compared it with *D. mutisii* (= *D. coerulea* var. *coerulea*). Macbride (1927, l.c.) disagreed with Ulbrich on this point, but found no closer relative.

80c. DALEA CYLINDRICA Hooker var. HAENKEANA Barneby

(Plate LXXXI)

Suggesting slender, diminished forms of var. *cylindrica*, but variable in habit, suffruticose but either erect or prostrate, rarely radicant if humifuse, in shelter becoming (acc. Ferreyra) 1 m tall, usually less than 5 dm, the young growth silky-strigulose with subappressed hairs up to ± 0.15–0.3 mm long, the foliage green, the leaflets commonly glabrous above, sometimes also beneath; *primary leaves* 1.5–3 cm long, the 4–6 often rather distant pairs of leaflets 1.5–5 (6) mm long; *calyx* 4.2–5.6 mm long, the tube externally glabrous or thinly (rarely densely) pilosulous with weakly spreading hairs up to 0.5–0.8 mm long, the intercostal membranes charged with 4–7 golden or reddish glands; *petals* bicolored, the whitish (rubescent) banner glabrous dorsally, the epistemonous ones blue. — Collections: 9 (o).

Open hillsides, sometimes in shelter of second-growth brush, or on stony slopes and ridges laid waste by erosion, 2750–3750 m, along the Andes of centr. and n. Peru, mostly in the drainage of Río Marañón, from Huánuco n. to Cajamarca, s. just into Pasco and attaining the Pacific slope in La Libertad and possibly in Ancash. — Flowering January to July, perhaps all year. — *Material*: PERU. s. l., *Haenke 1829* in 1790 (NY). CAJAMARCA. Cutervo: *Sandeman 4129* (F, K, OXF); typus of *D. cuterovoana*. LA LIBERTAD. Otuzco: *A. López Miranda 0115* (US); holotypus. _____: Trujillo to Huamachuco, *Ferreyra 3002, 3009* (US). ANCASH. _____ : Cordillera Blanca, *Kiurzl P 2293* (NY). HUÁNUCO. Dos de Mayo: typus of *D. catatona*. PASCO. Cerro de Pasco: *Ferreyra 6599* (F, US).

Dalea cylindrica Hook. var. **haenkeana** (Thaddaeus Haenke, 1761–1817) Barneby, var. nov., a var. *cylindrica* imprimis habitu graciliori, foliolis parvis 2–6 (6) nec 7–14 mm

longis, stipulis abbreviatis absimilis. A var. *nova* (Ulbr.) Barneby dentibus calycinis haud rigidescentibus, spicisque et primis abbreviatis separanda. — PERU. La Libertad. Otuzco: Agallpampa, 3270 m, Maio 22, 1952, *A. López Miranda 0886*. — Holotypus, US.

Dalea cutervoana (of Cutervo) Szyszył. in Polska Akad. Umiet. Wyd. mat...Rozpravy II, **9**: 221. 1895. — "Cutervo, Jelski no. 224." — Holotypus, collected by Const. de Jelski in May, 1879, accompanied by exquisite floral analysis by Szyszyłowicz, KRA!

Parosela catatona (stretched down, lowly) Macbr., Field Mus., Bot. **4**: 105. 1927. — "Peru:...Chasqui, Dept. of Huánuco, July 27–Aug. 13, 1922, *Macbride & Featherstone 1770*..." — Holotypus, F! isotypus, US! *Field Neg. 50194*, F, NY! — *Dalea* catatona (Macbr.) Macbr., Candollea **7**: 222. 1937.

The material referred above to var. *haenkeana* is diverse in detail, especially in distribution of pubescence and in number of flowers to the spike. The holotypus has oblong spikes of about 20–30 flowers and calyces thinly pilose from base upward. It is a close match for the plant collected somewhere in Peru in 1790 by Haenke, the plant to which I first attached the varietal name. Except for the calyx, which is glabrous and vernicose up to the pilosulous orifice and teeth, *Ferreyra 3309* from the same department is essentially identical. These specimens are from slender, diffuse subshrubs of some 3–6 dm in stature, and differ from var. *cylindrica* in their delicate growth-habit, small leaflets, and short spikes. The petals are blue, but in this respect not different from the phase of var. *cylindrica* that has been collected in Ancash. My concept of var. *haenkeana* has been built up by accretion around these three collections. The Sandeman collection from near Llama in Cutervo (Cajamarca) seems to represent a more slender, truly prostrate and matted state of the phase with externally glabrous calyx-tube. It was identified by Sandwith as "near *D. catatona*" and I suspect that the holotypus of the latter, which differs in its thinly pilose calyx, represents a parallel but possibly independent modification of var. *haenkeana*, perhaps an ecological variant from an unusually barren or exposed habitat. The spike of the original *P. catatona* is reduced to two to five flowers, suggesting an altogether distinct sort of dalea; but the cited specimen from Cordillera Blanca in Ancash provides a transitional spike of 6–12 flowers. Only tentative taxonomic judgments can be made on the status of these forms until much larger and more complete collections can be studied, preferably in the field.

In La Libertad and Cajamarca var. *haenkeana* is vicariant and marginally sympatric with var. *nova* and transitional individuals are known from the area. Ideally var. *nova* is a coarser, more obviously glandular-verruculose plant with slightly more numerous leaflets, at least in primary leaves that are often inconveniently lacking from many flowering specimens. The feature most useful in distinguishing var. *nova* is the usually characteristic calyx with its stiff, corneous-margined and thick-ribbed, distally glabrate teeth.

A peculiar dalea resembling var. *haenkeana* in foliage and flower but differing in promptly deciduous bracts was collected at ± 3400 m between Celendín and Cajamarca (prov. Celendín) by Ferreyra (*no. 15,122*, NY, US). The material is too scanty and too young for dependable analysis, but may well represent an undescribed entity.

80d. Dalea cylindrica Hooker var. nova (Ulbrich) Barneby
(Plate LXXXII)

Herbaceous becoming softly fruticose, highly variable in stature, erect, diffuse, or in exposed sites even humifuse, at anthesis (0.3) 0.5–2 m tall, the stems at least distally verruculose; *primary leaves* (1.5) 2–5.5 cm long, the 6–10 (11) pairs of leaflets 5–13 (17) mm long, glabrous above; *calyx-tube* thinly pilose with lustrous hairs up to 0.8-1.5 mm long, the ribs early becoming stout and prominent, the intervals charged with 3–5 small, yellow or golden glands, the apically glabrate teeth stiff and corneous;

banner whitish (rubescent), either glabrous or puberulent dorsally; *epistemonous petals* usually vivid cobalt blue, sometimes violaceous; *spikes* (1.5) 2–9 cm long. — Collections: 34 (o).

Dry stony crests and hilltops, hill pastures, and banks of eroded gullies, descending into scrub and valley flats, in exposed sites diffuse or prostrate becoming erect and bushy in protected ones, mostly 2150–3000 m, but in Ecuador descending in dry barrancas to 1200 m, locally abundant in the inter-Andean valleys of centr. and n. Peru, from Junín n. to Amazonas and Piura, and n. through Ecuador as far as Chimborazo, from La Libertad n.-ward extending across the Divide to the edge of the Pacific slope, s.-ward entirely e. of the Divide. — Flowering nearly all year. — *Representative*: ECUADOR. CHIMBORAZO: *A. S. Hitchcock 20,745* (NY, US). CAÑAR: *Prieto P-174* (K, NY). AZUAY: *Camp 2528* (F, NY, US); *Rose, Pachano & Rose 22,815* (NY, US). LOJA: *Seemann 753* (K); *D. H. Knight 755* (NY, WIS). PERU. PIURA. Huancabamba: *Sandeman 4272* (K, OXF). CHACHAPOYAS. Chachapoyas: *Wurdack 415* (NY, UC, US); *Mathews s. n.* (F, K, NY). CAJAMARCA. Cutervo: *Sandeman 4075* (K, OXF); *Ferreyra & Acleto 15,351* (NY, US). Chota: *Stork & Horton 10,053* (F, K, UC). Celendín: *Ferreyra 15,046* (NY, US); *Hutchinson & Wright 5126, 5262* (NY). Cajamarca: *Ferreyra 3229, 3284* (US); *Hutchinson & Wright 5057* (NY, UC, US). LA LIBERTAD. Otuzco: *López Miranda 0608* (US). HUÁNUCO. Ambo: *Mathews 930* (K, OXF); *Sawada P.112* (F). Huánuco: *Ferreyra 6694* (US). JUNÍN. _____ : Uspachaca, *Macbride 1302* (F).

Dalea cylindrica Hook. var. **nova** (Ulbr.) Barneby, stat. nov., based on *D. nova* (new) Ulbr., Feddes Repert. **2**: 5. 1906. — "Peruvia: Depart. et provincia Cajamarca, supra San Pablo 2400–2700 m. (A. Weberbauer, Fl. v. Peru no. 3838 — spec. fl. et fr. coll. 26. april 1904.)." — Holotypus, formerly B, survives as *Field Neg. 732*, F, NY, US! — *Parosela nova* (Ulbr.) Macbr., Field Mus., Bot. **4**: 110. 1927.

Parosela sawadae (Mosaho Sawada, collected in Peru ca 1927) Macbr., Field Mus., Bot. **11**: 24. 1931. — "Peru: Huánuco, *Sawada* P 11...San Rafael, Dept. of Huánuco, *Sawada* P 112." — Holotypus, *Sawada P-119* (not *P-11*), F! paratypus (*Sawada P 112*), F! — *Dalea sawadae* (Macbr.) Macbr., Candollea **7**: 223. 1937.

The material assembled under the heading of var. *nova* is diverse in superficial appearance. An observant collector (*F. Woytkowski 5*, F) records that the species is common around Celendín in Cajamarca, where it occurs both in the valley and on the higher hills. In hedges where protected from wind and grazing, the plants shoot up to a height of nearly 14 dm, but in open hill country they assume a diffuse or even prostrate form, running together in "wide clusters like heather," seldom over 5 dm tall. Primary leaves on long branches of the taller type are composed of up to 9–11 pairs of realtively large leaflets; and the first spike of each primary axis is usually leaf-opposed and long-pedunculate. In the lowly phase the majority of inflorescences are borne terminal to short branchlets set with shorter leaves composed of only 3–7 pairs of leaflets. In addition to these seasonal and edaphic variants there is an expectable instability in vesture and in density of glands on the bracts, peduncles and young stems. As a result it is not easy to characterize var. *nova* in exact terms. Over much of its range in Peru it coexists with var. *haenkeana*, which resembles its dwarf aspect, but differs in having the calyx nearly of var. *cylindrica*; and with the superficially rather similar *D. coerulea* var. *longispicata*. In Ecuador it enters the range of *D. coerulea* var. *coerulea*. The two entities last mentioned have often been confused with var. *nova*, but can be separated as follow:

1. Calyx-teeth pilose-plumose from base to apex, the tips surpassed by at least some hairs; *dorsal calyx-tooth* 2.7–5.5 mm long, at least as long and commonly much longer than the tube, flexuous in age, the marginal nerves not greatly thickened. *D. coerulea.*

1. Calyx-teeth pilose at base and internally, the glabrous tips surpassing the longer hairs, the haifs ordinarily reduced in length upward; *dorsal calyx-tooth* 1.7–2.7 (3) mm long, at least 0.2 mm shorter than the tube, erect and stiffened in age by the corneous marginal and costal nerves. *D. cylindrica* var. *nova.*

81. Dalea myriadenia Ulbrich
(Plate LXXXIII)

Suffruticose or fruticose, sometimes procumbent or diffuse but probably sometimes erect, ± 0.6–1 m tall, appearing glabrous to the spikes but the young branchlets, stipules, and leaf-stalks minutely or transiently puberulent, the growing stems greenish or purplish, prominently and densely gland-verrucose, the foliage green, the thick-textured leaflets smooth above, sprinkled beneath with raised livid glands, glabrous or puberulent dorsally along the slender midrib; *leaf-spurs* 1–1.5 mm long, when dry livid, wrinkled; *stipules* subulate 1.5–2.5 mm long, thick-textured; *intrapetiolular glands* 2, small, sometimes spiculiform; *post-petiolular glands* large, conic, orange or golden; *leaves* petioled, the main cauline ones (few seen) drought-deciduous, up to 2.5–3.5 cm long, with narrowly thick-margined rachis and 4–6 (7, or ex char. 8) pairs of narrowly obovate to oblong-elliptic, obtuse but bluntly gland-mucronate, flat or shallowly navicular leaflets up to 6–9 mm long, the terminal one stalked but not larger than the last pair, the leaves of branchlets and axillary spurs shorter, with 2–5 pairs of smaller leaflets; *peduncles* except the first of each main axis terminal to leafy branchlets, the first up to 2–4 cm, the rest 0–2 cm long, puberulent or (near the spike) pilosulous; *spikes* loose or early becoming so, the flowers (pressed) falling into 2–3 ranks and exposing much of the very densely and softly pilosulous axis (hairs to 0.2–0.25 mm long), this finally 2.5–6 cm long; *bracts* persistent, clasping the calyx, the broadly ovate, papery body 3.3–4.8 mm long, in profile (1.8) 2–2.4 mm wide, dorsally charged with many elliptic blister-glands but either glabrous or beyond middle thinly pilosulous, ciliolate distally and passing into a subulate incurved gland-tipped tail 1.5–3 mm long; *calyx* 4.1–4.7 mm long, the shortly and broadly campanulate tube 3–3.6 mm long, thinly pilosulous with fine spreading spiral hairs up to 0.5–0.6 mm long, the ribs slender, castaneous (livid-margined) scarcely prominent, the membranous flat intervals all (or at least the broader ventral ones) charged with 2 irregular rows of smaller suborbicular and longer elliptic or linear-elliptic blister-glands up to 0.6–0.7 mm long, the orifice a little oblique but not abruptly recessed behind banner, densely pilose within and marginally with a fringe of erect hairs up to 0.5–0.7 mm long, the teeth unequal, the dorsal one deltate-triangular and short-apiculate, 1–1.2 mm long, the rest much broader and shorter, broader than long, depressed-deltate and shortly gland-apiculate, often 1–2-gland-spurred; *petals* essentially as in *D. coerulea* in form and color, all gland-tipped, the banner sprinkled with many glands, dorsally glabrous, the epistemonous ones perched 1.8–2.3 mm above hypanthium; *banner* 7.6–8.3 mm long, the claw 3–4 mm, the suborbicular-cordate blade 5.3–6.3 mm long, 5.6–6.6 mm wide; *wings* 7–7.7 mm long, the claw 2–2.4 mm, the ovate-oblong blade 5.5–6.7 mm long, 3.4–4.1 mm wide; *keel* 9.5–11 mm long, the claws 2.8–4.2 mm, the blades 7.4–8 mm long, 4.3–4.6 mm wide; *androecium* 10-merous, 11.5–12.5 mm long, the longer filaments free for 3.3–3.6 mm, the connective gland-tipped, the anthers 0.7–0.8 mm long; *pod* isotriangular, the style-base at corner, the sutures subfiliform, the valves membranous and glabrous proximally, thence papery, pilosulous, gland-sprinkled. — Collections: 2 (o).

Open brushy hillsides, 2700–2900 m, local, known only from the valleys of Río Marañón and its affluents in Cajamarca (prov. Chota and Cutervo) and Amazonas (prov. Chachapoyas), Peru. — Flowering June to August, probably at other times. — *Material*: CAJAMARCA. Chota: Chota to Lajas, *Ochoa 1541* (F). Cutervo: Cutervo, *Ferreyra & Acleto 15,386* (NY, US).

Dalea myriadenia (with innumerable glands) Ulbr., Feddes Repert. **2**: 9. 1906. — "Peruvia: In declivibus orientalibus vallis fluminis, qui Maranon dicitur supra Balsas in departimento Amazonas, provinciae Chachapoyas (A. Weberbauer no. 4279.... 25. junio 1904)." — Holotypus, formerly B, survives as *Field Neg. 731*, F, NY, US! — *Parosela myriadenia* (Ulbr.) Macbr., Field Mus., Bot. **4**: 108. 1927.

Resembling and doubtless related to *D. coerulea* and *D. cylindrica* var. *nova*, and sympatric with the latter, but distinguished from both by the peculiar, short-toothed calyx with biseriate glands in the intercostal membranes. The thinly pilose pubescence of the calyx-tube contrasts strongly with the silvery-fringed orifice. Despite the epithet *myriadenia*, the plant is hardly more densely glandular than some forms of var. *nova* collected in Cajamarca. The bracts are similar to those of var. *nova* but in proportion to the subtended calyx substantially more ample.

82. DALEA WEBERBAUERI Ulbrich

(Plate LXXXII)

Suffruticose or softly fruticose, in exposed sites diffuse or prostrate but when protected up to 1 m tall, silky-pilosulous nearly throughout with fine ascending and forwardly subappressed hairs up to 0.25–0.8 (1) mm long, the old wood glabrate, the young branchlets and peduncles at least sparsely, often prominently verruculose, the herbage when young and often permanently gray-silky, sometimes greenish in age, the leaflets pubescent both sides, livid-punctate beneath; *leaf-spurs* 0.6–1.2 mm long; *stipules* narrowly triangular to lanceolate, livid-castaneous, papery, 1–3.5 (4) mm long, thinly puberulent dorsally; *intrapetiolular glands* 2, spiculiform; *post-petiolular glands* small but prominent, obtuse; *leaves* shortly petioled, the primary cauline ones 1.2–2.5 (3) cm long, with narrowly margined rachis and 4–7 pairs of obovate or oblong-elliptic, obtuse but gland-mucronulate, flat or loosely folded leaflets 2–8 mm long, the upper spur-leaves (sometimes all remaining at anthesis) shorter, with (2) 3–5 pairs of smaller leaflets; *peduncles* (0) 0.5–6 cm long, the first of each primary stem leaf-opposed, the rest terminal to branchlets; *spikes* rather loose (or becoming so), the calyces (pressed) ± 2–3-ranked after anthesis, without androecia or petals ± 1 cm diam, the densely pilosulous axis becoming (1) 1.7–6 cm long; *bracts* persistent or deciduous at late anthesis, 3–7 mm long, variable according to variety (cf. key), papery with scarious, often brown-tinged margins, dorsally strigulose-pilosulous and gland-sprinkled, the tail 0.6–5 mm long; *calyx* (4.4) 4.5–6.2 mm long, pilose with fine straight ascending lustrous hairs up to 0.6–1.5 mm long, the tube (measured to dorsal sinus) (2.8) 3–4 mm long, the orifice oblique but not recessed behind banner, the filiform ribs usually livid, the wide membranous intervals charged with 1 row of 3–5 small yellow glands, the teeth deltate- to broadly triangular-subulate, slightly unequal, the dorsal one longest and narrowest, 1.3–2.3 (2.5) mm long (1.3–2.1 mm shorter than tube); *petals* bicolored, the banner greenish-white with often colored basal lobes, early rubescent, gland-tipped and -sprinkled, usually glabrous dorsally (sometimes a small tuft of hairs), the epistemonous ones blue or purple, perched

1.8–3 mm above hypanthium, the keel and often the wings gland-tipped; *banner* 7.5–9 mm long, the claw 3.5–4.5 mm, the suborbicular-cordate, shallowly emarginate, hooded blade open at base, 5–6 mm long, 5.4–6.4 mm wide; *wings* 7–8.8 mm long, the claws 2–2.8 mm, the obliquely ovate blade 6.3–7.3 mm long, 3.4–4.1 mm wide; *keel* 7.2–10.2 mm long, the claws 2.8–4 mm, the blades (5.1) 5.6–7.3 mm long, 3.4–4.1 mm wide; *androecium* 10-merous, 8.5–11.5 mm long, the longer filaments free for 3.4–4.5 mm, the connective gland-tipped, the anthers 0.75–0.95 mm long; *pod* obtusely subisotriangular, 3.1–3.4 mm long, the style-base at corner, the prow slenderly castaneous-keeled, the valves thinly papery in upper ⅔, pilosulous and sparsely glandular, glabrous hyaline at base; *seed* 2 + mm long, not seen ripe.

Like several kindred Andean daleas, *D. weberbaueri* is more easily recognized than characterized. It is obviously close to the sympatric *D. cylindrica* var. *haenkeana*, from which it differs principally in the gray-silky foliage and more readily disjointing bracts. In this last feature it approaches *D. smithii*, its neighbor to the immediate southeast, but this also has greenish foliage and slightly more numerous (5–9 not 4–6 or 7) pairs of leaflets. Discontinuities between these taxa are not yet established and cannot be large. Until they can be tested in the field it seems preferable to follow Macbride (1943) with one reservation: I am unable to exclude from *D. weberbaueri* the plant that Ulbrich described as *D. sericophylla*, which differs only in its long-tailed bracts, slightly larger leaflets, and slightly denser spikes. The also very nearly related *D. fieldii*, which Macbride ultimately reduced to *D. sericophylla*, has on the other hand some small technical characters which for the present serve to exclude it from *D. weberbaueri*.

Key to the Varieties of *Dalea weberbaueri*

1. Bracts 3–5.5 mm long, broadly ovate, short-acuminate, the body 1.3–2 mm wide as seen in profile, the tail 0.6–2 mm long; Cajamarca s.-ward, apparently common. 82a. var. *weberbaueri*.
1. Bracts 5–7 mm long, narrowly lance-acuminate, the body at base 0.8–1.2 mm wide in profile, the tail 2.5–5 mm long; Cajamarca (prov. Contumazá and Hualgayoc), apparently local. 82b. var. *sericophylla*.

82a. Dalea weberbaueri Ulbrich var. weberbaueri

(Plate LXXXII)

Foliage silvery when young, sometimes greenish in age; *leaflets* mostly small, 2–6 mm long; *spikes* usually becoming loose in age or at full anthesis, a few flowers toward base separated by the width of a calyx; *flowers* large, the keel-blades 6.3–7.3 mm long, 3.4–4.1 mm wide. — Collections: 14 (o).

Stony clay hillsides and thinly wooded or brushy canyon walls, 2100–3600 m, apparently not uncommon locally, both slopes of the Peruvian Andes from Cajamarca (prov. Celendín and Cajamarca) s. through La Libertad and Ancash and on the Atlantic slope in Junín and n. Huancavelica. — Flowering October to June, probably later. — *Representative*: Cajamarca. Celendin: *Ferreyra 15,024* (F, US). Cajamarca: *D. & V. Ugent 5510* (NY). La Libertad. Santiago de Chuco: *López Miranda 0987*

(US). ANCASH. Huaraz: *Sandeman 4642* (K, OXF). Bolognesi: *Ferreyra 5723, 5726, 7552, 7573* (US). JUNÍN. Tarma: *Killip & Smith 21,826, 21,937* (F, NY, US). HUANCAVELICA. Huancavelica: *Tovar 305* (US).

Dalea weberbaueri (August Weberbauer, 1871–1948) Ulbr., Feddes Repert. **2**: 9. 1906. – "Peruvia: inter Tarma et Palea in petrosis 2600–3000 m. s. m. (A. Weberbauer, Flora von Peru no. 1739 – leg. spec. florif. et fructif. 26. XI. 1902). Prope Tarma in departimento Junin in declivibus petroso-argillosis 3000–3300 m. s. m. specim. florif. leg. A. Weberbauer 9 Februario 1903 sub no. 2371." – Holotypus (*Weberbauer 1739*), formerly B, survives as *Field Neg. 738*, F, NY, US! – *Parosela weberbaueri* (Ulbr.) Macbr., Field Mus., Bot. **4**: 105. 1927.

The approximate topotypes collected by Killip & Smith serve, since destruction of the original gatherings described by Ulbrich, as standards for comparison. In the southern, transmontane lobe of its range, var. *weberbaueri* is distinguished from all compatriot daleas, except *D. fieldii* (discussed under var. *sericophylla* below), by its gray-silky foliage. The whole range of the variety is nearly conterminous with that of *D. cylindrica* var. *haenkeana*; the flowers and foliage are much alike in form, and it is possible that the two taxa as defined herein are based on an artificial separation of glabrate and silky populations of one specific type. On the Pacific slope, where var. *weberbaueri* occurs within the range of *D. cylindrica*, it is usually distinguished without difficulty by the more condensed habit of growth, smaller leaves and leaflets, and silky vesture not only of the leaves but of the calyx. The specimen cited from La Libertad is, however, somewhat intermediate, having the growth and calyx-vesture of var. *weberbaueri* combined with glabrous leaflets. Here again the picture is clouded and the evidence available inconclusive.

82b. DALEA WEBERBAUERI Ulbrich var. SERICOPHYLLA (Ulbrich) Barneby
(Plate LXXXII)

Foliage permanently silvery; *leaflets* up to 8 mm long; *spikes* densely flowered from base upward; *keel-blade* (little known) 5.1–5.6 mm long, 3–3.2 mm wide. – Collections: 2 (o).

Habitat unknown, but to be expected on open mountain slopes or in thin brush, 3100–3430 m, known only from Cajamarca, Peru (prov. Contumazá and Hualgayoc). – Flowering from lateral branchlets May–July, earlier from short, leaf-opposed peduncles. – *Material*: CAJAMARCA. Hualgayoc: typus. Contumazá: Las Achiras (hda. San Lorenzo), *A. Sagástegui 3881* (US).

Dalea weberbaueri Ulbr. var. **sericophylla** (Ulbr.) Barneby, stat. nov., based on *D. sericophylla* (silky-leaved) Ulbr., Feddes Repert. **2**: 7. 1906. – "Peruvia: Hacienda La Tahona prope Hualgayoc (Depart. Cajamarca) 3100 m. s. m. (A. Weberbauer no. 4017... 13. maio 1904...)." – Holotypus, formerly B, survives as *Field Neg. 734*, F + fragm. clastotyp., NY, US! – *Parosela sericophylla* (Ulbr.) Macbr., Field Mus., Bot. **4**: 105. 1927.

Contrary to Macbride's final opinion that *D. sericophylla* Ulbr. is an earlier synonym of *D. fieldii* Macbr., I believe the taxa to be distinct. The two known specimens of var. *sericophylla*, both from Cajamarca, differ collectively from *D. fieldii*, known with certainty only from far south in Dept. Pasco, in their lanceolate rather than linear-setiform stipules and their relatively short calyx-teeth. In both specimens the spikes are mostly subsessile and terminal to leafy branchlets, a seasonal aspect, common in *Dalea*, that is closely matched by one example of var. *weberbaueri* from Ancash (*Ferreyra 7573*, US).

From this var. *sericophylla* differs principally in the narrow, elongate bracts drawn out into a firm tail longer than the body. Bracts of similar form are found, it is true, in *D. fieldii*, which may, after all be no more than one more local form of the same species, but seems in the present state of knowledge further apart from var. *sericophylla* than the latter is from var. *weberbaueri*.

83. Dalea fieldii (Macbride) Macbride
(Plate LXXXIV)

Suffruticose becoming shrubby, up to 1.2 m tall, with castaneous, remotely (under the spikes more densely) verruculose stems, softly villous-villosulous throughout with extremely fine spreading-ascending and partly twisted hairs up to 0.65–1.1 mm long, the foliage gray-silky when young, later greenish, the thin-textured leaflets pubescent both sides, punctate beneath; *leaf-spurs* 0.7–1.5 mm long; *stipules* linear-setiform, firm, green becoming brownish, villosulous dorsally, (2) 3–6.5 mm long; *intrapetiolular glands* 2, setiform; *post-petiolular glands* small but prominent, sometimes concealed by vesture; *leaves* shortly petioled or subsessile, the main cauline ones 2–4.5 cm long, with 5–7 pairs of oblong-elliptic, short-acuminate, flat or mostly flat leaflets up to 7–14 mm long, the terminal one either short-stalked or sessile; *peduncles* (in material seen) mostly leaf-opposed, 5–9 cm long; *spikes* moderately dense, ovoid becoming oblong, without petals 11–12 mm diam, the calyces (pressed) mostly 3–4-ranked, not wholly concealing the villosulous axis, this becoming 2–6.5 cm long; *bracts* persistent, narrowly lance-acuminate, 4.5–7 mm long, in profile 0.7–0.9 mm wide shortly above base, firm except for a narrow scarious margin in the lower ¼, dorsally densely pilosulous but not strongly glandular, the tail 3–4 mm long; *calyx* 5.6–6.2 mm long, villosulous with fine spreading spiral hairs up to 1–1.2 mm long, the tube 2.8–3.3 mm long, the orifice oblique but not abruptly recessed behind banner, the filiform ribs livid, the membranous intervals charged with (3) 4–7, 1- or irregularly 2-ranked, small yellow glands, the unequal teeth lance-attenuate from a triangular base, the dorsal one 2.5–3 mm long (0.1–0.8 mm shorter than tube), the ventral pair shortest, all gland-spurred; *petals* bicolored, the whitish, basally blue-lobed, heavily gland-sprinkled banner rubescent in age, glabrous dorsally, the epistemonous ones blue, gland-tipped, perched ± 1–2 mm from hypanthium; *banner* 6.7–7.6 mm long, the claw 4.2–4.6 mm, the ovate-suborbicular, emarginate, hooded blade 4.2–4.6 mm long, 4–4.4 mm wide; *wings* 6.7–7.6 mm long, the claw 2.4–2.7 mm, the ovate-oblong blade 5.2–5.7 mm long, 2.7–3 mm wide; *keel* 8.6–9.6 mm long, the claws 3–3.8 mm, the blades 5.5–6.3 mm long, 3.2 mm wide; *androecium* 10-merous, 9–10.5 mm long, the longer filaments free for 3–3.3 mm, the connective gland-tipped, the anthers 0.65–0.8 mm long; *pod* unknown. — Collections: 3 (o).

Brushy canyon slope, ± 2850 m, known only from the type-locality in the valley of upper Río Huallaga in Pasco, Peru. — Flowering March to June, probably later. — *Material*: Pasco: Huariaca, *Macbride 3108* (F). Peru, s. l., *Haenke 1722* in 1970 (NY).

Dalea fieldii (Macbr.) Macbr., Candollea **7**: 222. 1937, based on *Parosela fieldii* (Capt. Marshall Field, sponsor of collectors in Peru) Macbr., Field Mus., Bot. **4**: 111. 1927. — "Peru:...Huariaca, Dept. of Junin [now Pasco], April 3, 1923, *Macbride 3117*..." — Holotypus, F! isotypus, US!

A poorly known and poorly characterized species, differing from its compatriot relative *D. weberbaueri* var. *weberbaueri* in the longer pubescence of fine, weak hairs, in the

longer and narrower stipules, bracts, and calyx-teeth, and in the larger leaflets of thinner texture. Macbride (1943) reduced it to *D. sericophylla* (= *D. weberbaueri* var. *sericophylla*), with which it shares the character of long narrow bracts, here interpreted as coincidental.

84. DALEA ONOBRYCHIS DeCandolle
(Plate LXXXV)

Suffruticose or perhaps weakly shrubby in age, 6–15 dm tall, the diffuse or ascending, castaneous or livid stems paniculately branching distally, at least when young puberulent or pilosulous with weak subappressed and ascending hairs up to 0.3–0.5 (0.6) mm long, and charged with scattered hemispherical or subglobose (grainlike) warts, the foliage green but the leaflets at least puberulent beneath, smooth above, charged beneath with raised dots; *leaf-spurs* 0.8–2 mm long; *stipules* linear-acuminate, (2) 3–6 mm long; *intrapetiolular glands* 2, small but prominent; *post-petiolular glands* prominent, hemispherical, livid-castaneous; *leaves* mostly short-petioled, the main cauline ones 4–7 (8) cm long, with slender, narrowly margined rachis and 5–8 (9) pairs of obovate, oblong-obovate, or -elliptic, obtuse and gland-mucronulate, or apiculate, or weakly emarginate, flat, dorsally slender-carinate leaflets 6–16 (some at least (7) 9) mm long, the terminal one stalked; *peduncles* mostly leaf-opposed, usually much longer than the associated leaf, the lowest of each primary axis (0.7) 1–2 dm, rarely only 3–7 (10) cm long, those terminal to leafy lateral branchlets, if present, always shorter; *spikes* many-flowered, dense but not conelike, ovoid-acuminate becoming a little looser and cylindroid, without petals (8) 9–11 mm, the densely villosulous axis becoming 3.5–8 cm, rarely not elongating but capitate and only 0.5–1.5 cm long; *bracts* deciduous by full anthesis, but sometimes held fast between crowded calyces, 4–6 mm long, the ovate navicular, thinly papery body 3.2–4 mm long, in profile (1.3) 1.6–2 mm wide, densely pilosulous except toward the membranous margins, inconspicuously gland-charged dorsally, abruptly contracted into a linear, often incurved, livid tail (1) 1.3–1.9 mm long; *calyx* 3.7–4.8 mm long, pilosulous from base upward with straight ascending hairs up to 0.6–0.9 mm long, or sometimes glabrate on the abaxial side, the tube 2.7–3.3 mm long, its orifice only little oblique, the ribs livid, subfiliform, the intervals charged with 1 row of ± 3–5 small, livid or golden glands, the teeth deltate to triangular-apiculate, somewhat unequal, the dorsal one longest and narrowest, 1–1.8 mm long (1.2–2.2 mm shorter than tube), the ventral pair broadest and shortest; *petals* bicolored, the gland-tipped and -sprinkled banner white at middle or distally, rubescent, the epistemonous ones either bright blue or amethystine-purple, perched much below middle of androecium (2–3 mm above hypanthium), the keel usually gland-tipped; *banner* 6.8–7.5 mm long, the claw 3.8–4.5 mm, the blade 4–4.4 mm long, 4.8–5 mm wide, open at base but the basal lobes incurved and adherent to form lateral pockets; *wings* 5.8–7.1 mm long, the claw 1.3–1.6 mm, the blade 5–5.6 mm long, 2.8–3.4 mm wide; *keel* 6.5–8.4 mm long, the claws 1.6–2.1 mm, the blades 5.2–6.8 mm long, 3.4–4 mm wide; *androecium* 8–9.5 mm long, the longer filaments free for 2.4–3.1 mm, the connective gland-tipped, the anthers 0.65–0.8 mm long. — Collections: 20 (o).

Open rocky and grassy hillsides, (450) 800–3250 m, widely but interruptedly dispersed along the w. slope of the Peruvian Andes from Cajamarca (prov. Contumazá) to Arequipa (prov. Condesuyos). — Flowering March to August, n.-ward perhaps indefinitely. — *Representative*: CAJAMARCA. Contumazá: *Sagástegui 3673* (US). LA LIBERTAD. Trujillo: *Chrestowski 1-18* (NY). LIMA. Canta: *Ferreyra 1983* (US);

Mathews 549 (K, p.p., NY). Lima: *Ferreyra 2844* (US). Huarochirí: *Killip & Smith 21,702* (F, NY, US); *Hutchinson 601* (K, UC, US); *Ferreyra 5421, 6962* (US); *Goodspeed et al. 11,515* (K, UC). AREQUIPA. Condesuyos: *Stafford 1209* (K).

Dalea onobrychis (resembling sainfoin) DC., Prod. **2**: 247. 1825 ("*Onobrychis*"). — "...in Peruvia...(v. s. comm. a cl. Lagasca)." — Holotypus, G-DC! — *Parosela onobrychis* (DC.) Macbr., Field Mus., Bot. **4**: 108. 1927.

The range of *D. onobrychis* lies wholly within that of the related and in many respects similar *D. cylindrica*; they are often exactly sympatric and subject to similar types of variation and as a consequence lack ideal sets of dependable differential characters. Along the Oroya highway east of Lima the two species, *D. cylindrica* represented by typical var. *cylindrica*, in this region with pale yellow petals more or less amethyst tinged, and *D. onobrychis*, with vivid blue or blue-violet petals, are most readily distinguished by flower-color, but a more important character is found in the bracts, those of *D. onobrychis* deciduous, submembranous, densely hairy externally, those of *D. cylindrica* persistent, firm, glabrous. Elsewhere, however, *D. onobrychis* may have amethyst- or reddish-purple epistemonous petals, shades not detectably different, at least in dried material, from some encountered in *D. cylindrica* sens. lat., and the bract remains the most valuable diagnostic feature. At its southern limit in Arequipa *D. onobrychis* closely approaches *D. pennellianus*, the only other perennial dalea known to occur on the Pacific slope of the Peruvian Andes. This also has deciduous bracts, but is a smaller, prostrate herb with looser spikes of longer calyces, in practice easily recognized though once again not strongly characterized.

The typus of *D. onobrychis* was sent to DeCandolle without any more precise locality than "Peru." We know, however that the species had been collected by Dombey about 1788–9 (*no. 855*, F, P) and was readily accessible to anyone travelling the trans-Andean highway from Lima to Tarma. The plant so closely resembles modern collections from this region that it is reasonable to suppose that it came from thereabouts, even though the actual collector cannot now be ascertained. In the Department of Lima the peduncle is characteristically elongate, the first one of each primary cauline axis being more than twice the length of its subtending leaf, generally 1–2 dm long; and the spike is ovoid in bud becoming at full anthesis and later oblong or cylindric. The same spike but borne on short peduncles characterizes the one known gathering from Arequipa (cited, supra); and in Cajamarca a curious, perhaps distinct form is known in which the short peduncle bears a greatly condensed and headlike spike only 0.5–2 cm long. Of this latter I have seen only one specimen in bud (*Sagástegui 3773*, US), and one in flower ("northern Peru", *Stordy*, K); they are connected to more typical *D. onobrychis* by another gathering (*Sagástegui 3673* from Contumazá) with an open spike up to at least 6 cm long. As nothing is known of the possible effects of environment and season on the rather diverse aspect of the material cited, it seems prudent to include them for the present in an inclusive concept of an apparently polymorphic species.

85. DALEA PENNELLII (Macbride) Macbride
(Plate LXXXVII)

Diffuse or prostrate perennial herbs from a tough woody root and shortly forking caudex, the slender, simple or few-branched, purplish-castaneous, remotely but prominently tuberculate, sparsely leafy stems (2) 3–5 dm long, thinly pilosulous throughout with fine weak subappressed or ascending hairs up to 0.2–0.5 mm long (often glabrate at base), the foliage similarly but often more densely pilosulous, greenish-cinereous, the purple-margined leaflets pubescent both sides, sometimes more densely so above,

punctate beneath, the few, long flower-spikes mostly leaf-opposed; *leaf-spurs* 0.7–1.2 mm long; *stipules* subulate to lanceolate, 1–2.5 mm long, firm, livid, pilosulous dorsally; *intrapetiolular glands* 2, often spiculiform; *post-petiolular glands* small but prominent, obtuse; *leaves* short-petioled, the main cauline ones (2) 2.5–4.5 cm long, about as long as the internodes, with narrowly margined, sparsely punctate rachis and 3–6 (7) pairs of oblong-obovate, -elliptic, or obovate-cuneate, obtuse or emarginate, flat or loosely folded leaflets (3) 4–10 mm long, the terminal one (of most leaves) shortly stalked and commonly more deeply retuse than the last pair; *peduncles* usually 1–2 per stem, (5) 7–15 cm long, humifuse but incurved distally, the spikes vertical; *spikes* rather loosely many-flowered, early becoming long and narrow, the flowers (pressed) falling in ± 3 ranks and partly exposing the villosulous axis, the first spike the largest, becoming 3–10 cm long, succeeding ones shorter; *bracts* promptly deciduous, 4.5–5.8 mm long, the elliptic navicular papery-membranous body 3–4 mm long, in profile 1.2–1.4 mm wide, slenderly livid-keeled, dorsally pilosulous and gland-sprinkled, glabrous within, contracted into a livid subulate tail 1.2–1.6 mm long; *calyx* 5.1–5.5 mm long, densely pilose with fine spreading-ascending spiral hairs up to 1.6–2.2 mm long, the tube 3–3.3 long, oblique at orifice, the black or livid ribs slender but prominent, the nearly flat membranous intervals charged with 1 row of 3–4 small golden glands, the triangular-acuminate teeth a little unequal, the dorsal one 1.8–2.5 mm long (0.5–1.1 mm shorter than tube), the ventral pair shorter and broader, all gland-spurred and -tipped; *petals* bicolored, the gland-tipped and -sprinkled banner opening white with purple basal lobes, finally rubescent, the epistemonous ones amethyst-purple, often pallid toward the outer edges, perched low on androecium (1.5–2.2 mm above hypanthium); *banner* 6.2–7.7 mm long, the claw 3–3.7 mm, the suborbicular-flabellate blade 4.1–4.5 mm long, 4.5–5.2 mm wide, the lobes incurved and subadherent, the cornet at base shallow or subobsolete; *wings* 6–6.5 mm long, the claw 2–2.2 mm, the obliquely ovate blade 4.7–5 mm long, ± 3 mm wide; *keel* 8.7–10.2 mm long, the claws 2.7–3.4 mm, the blades 6.4–7.1 mm long, 4.3–4.9 mm wide; *androecium* 10-merous, 8–10.6 mm long, the longer filaments free for 2.7–3.6 mm, the connective gland-tipped, the anthers pallid, 0.9–1.05 mm long; *pod* not seen. — Collections: 8 (o).

Open rocky hillsides and gravelly stream-beds, 2200–2600 m, apparently local, collected frequently in the foothills of El Misti around Arequipa in s.-w. Peru, and (on poor evidence) extending s. to Cordillera Quebrada de Quipisca in Tarapacá, n. Chile. — Flowering March to June. — *Material*: PERU. AREQUIPA: Arequipa and vicinity, *Tate 1198* (NY), *Weberbauer 6554* (F), *Sandeman 3770a* (K), *3937* (F, OXF), *Rauh-Hirsch in 1954* (NY), *Eyerdam & Beetle 22,122* (UC). CHILE. TARAPACÁ: Parca, Tarapacá prov., *Werdermann 1112* (F, K, NY, US), the specimens mostly in bud only.

Dalea pennellii (Macbr.) Macbr., Candollea **7**: 223. 1937, based on *Parosela pennellii* (Francis Whittier Pennell, 1886–1952) Macbr., Field Mus., Bot. **4**: 107. 1927 ("*Pennellii*"). — "PERU: ... above Arequipa, April 7–16, 1925, *Pennell 13171*..." — Holotypus, F! = CNHM Phototype *Neg. 50207*! isotypi, GH, K, NY, US!

An exceptionally attractive dalea, easily recognized by facies but lacking strong technical differential characters. The notable features are humifuse herbaceous stems, few (mostly 3–6) pairs of leaflets, an often heteromorphic odd leaflet, and long-pedunculate, eventually loose and narrow spikes from which the interfloral bracts fall off before expansion of the handsome amethyst-purple and whitish petals. Macbride compared the species with *D. boliviana*, similar in growth-habit but readily distinguished by the shorter peduncles and persistent bracts. In the early ebracteate spike *D. pennellii* resembles the also cismontane but more southern *D. azurea*, as well as *D. smithii* of the transmontane

slope in southern Peru. Both of these have more or less erect, distinctly fruticose stems, shorter peduncles, and blue epistemonous petals. the more nearly sympatric *D. azurea* differing further in its massive erect spikes of more crowded calyces. The relationship between *D. pennellii* and *D. smithii* seems especially close and may well need reevaluation as more is learned of each.

At Arequipa *D. pennellii* is associated with the form of *D. cylindrica* described as *Parosela rubricaulis*, a suffruticose plant up to a meter tall, with persistent bracts and a glabrous calyx-tube charged with livid glands. Not actually known to occur with *D. pennellii* but reaching south into Arequipa is *D. onobrychis*, another relatively tall species; this has the long (but not humifuse) peduncle of *D. pennellii* and deciduous bracts, but the bracts themselves are broader, the spike is denser, and the calyx-teeth shorter. The constancy of these characters requires the test of more material.

86. Dalea azurea (Philippi) Reiche
(Plate LXXXVII)

Openly branching twiggy shrubs up to 6 dm tall and twice as broad, the livid-castaneous, densely low-tuberculate stems when young finely but densely silky-pilosulous with subappressed hairs up to 0.2–0.3 mm long, the foliage green but the leaflets bicolored, brighter green and glabrous above, beneath densely finely pilosulous and punctate, the proportionately large and thick spikes terminal to main branches; *leaf-spurs* 0.8–1.2 mm long; *stipules* subulate or lanceolate, 1.5–4.5 mm long, firm, densely pilosulous dorsally, glabrous and castaneous within; *intrapetiolular glands* 2, minute; *post-petiolular glands* small but prominent, conical or blunt; *leaves* short-petioled or subsessile, the main cauline ones 2.5–4.5 cm long, with stramineous, narrowly green-margined, glandless rachis and (4) 5–7 pairs of oblong-obovate or -oblanceolate, truncate-emarginate or obtuse but commonly gland-mucronulate, flat, dorsally keeled leaflets up to 7–14 mm long, the shortly stalked odd one a little smaller than last pair, the leaves of axillary spurs (if present) similar but shorter, with 3–5 pairs of smaller leaflets; *peduncles* stout, 2.5–6 cm long, appearing as the continuation of the primary stem-axis; *spikes* dense but not conelike, oblong-cylindroid, without petals or androecia 12–15 mm diam, the densely spreading-pilosulous axis becoming 2.5–8 cm long; *bracts* deciduous by full anthesis, 3.8–6.3 mm long, the navicular, broadly elliptic body (3) 3.5–5 mm long, in profile (1) 1.2–1.5 mm wide, hyaline-margined toward base, firmer, livid and gland-speckled toward middle, pilosulous dorsally, glabrous within, contracted into a subulate livid tail 0.8–1.3 mm long; *calyx* 5.7–6.8 mm long, densely pilose from base to tip of plumose teeth with fine straight spreading-ascending spiral hairs up to 1.1–1.8 mm long, the tube (measured to dorsal sinus) 3.1–3.5 mm, oblique at orifice, the slender prominulous ribs livid, the hyaline intervals little depressed, charged with 1 (sometimes irregular) row of 5–7 small yellow glands, the triangular-acuminate, minutely gland-spurred teeth somewhat unequal, the dorsal one 2.2–3.1 mm long (0.3–1.2 mm shorter than tube), the ventral pair shortest but hardly broader; *petals* bicolored, the banner white with blue basal lobes, gland-sprinkled and sometimes gland-tipped, rubescent, the epistemonous ones vivid blue, commonly gland-tipped, the blades of keel sometimes gland-sprinkled, perched low on androecium (1.3–2.2 mm above hypanthium); *banner* 7.8–8.2 mm long, the claw 2.1–2.7 mm long, the suborbicular-flabellate emarginate blade 5.2–5.5 mm long, 5.8–6.4 mm wide, open at base; *wings* 7.3–8.3 mm long, the claw 2.1–2.7 mm, the obliquely ovate-elliptic blade 5.7–6.6 mm long, 3.4–4 mm wide; *keel* 9.6–11.4 mm long, the claws 2.6–3.8 mm, the blades 7.3–8.7 mm long, 4.3–5 mm wide; *androecium*

10-merous, 10.3–12 mm long, the longer filaments free for 4–4.5 mm, the connective gland-tipped, the pale yellow anthers 0.8–0.9 mm long; *pod* 3–3.5 mm long, almost deltate in profile, the three sides almost straight, the prow slender, livid, the valves in lower half hyaline, in upper half papery, gland-sprinkled, densely pilose; *seed* (not seen ripe) less than 2 mm long. — Collections: 3 (o).

Rocky ledges of quebradas and dry brushy hillsides, in Atacama fog-desert, ± 150–250 m, known only from coastal Chile in lat. 24° 50–25° 5 S. — Flowering November and December. — *Material*: ANTOFAGASTA. Taltal: Cerro Yumbes near Paposo, *I. Johnston 5584* (F, US); Aguada Panulcito, trail to Andacaolla mines, *I. Johnston 5455* (F, GH, K); Agua de Perales, *I. Johnston 5585* (F, GH, topotypi).

Dalea azurea (Phil.) Reiche, Anal. Univ. Chile **97**: 499 [Fl. Chil. **2**: 77]. 1897, based on *Psoralea azurea* (sky-blue) Phil., Fl. Atacam. 14. 1860. — "Prope Paposo ad aquam de los Perales dictam circa 7000 p.s.m..." — Holotypus (SGO) not seen, but verified by I. Johnston (Contrib. Gray Herb., New Ser. **85**: 51. 1929) and matched against cited topotypes. — *Parosela azurea* (Phil.) Macbr., Field Mus., Bot. **4**: 107. 1927.

An especially handsome dalea, a small, densely branched xerophytic subshrub, described by Johnston as forming bushes wider than high, notable for the massive spikes of large blue and white flowers raised vertically above the foliage on short terminal peduncles. It is the only dalea found at low elevations on the nitrate coast, the only one known to occur on the Pacific coast south of the Tropic, a true desert dweller, sometimes associated with *Errazurizia multifoliolata*. In spite of considerable geographic isolation and adaptation to an extreme environment, *D. azurea* is not highly differentiated from kindred species of southern Chile, being in fact scarcely distinguishable from *D. pennellii* or *D. smithii* by any fine structural detail. In practice, however, the bushy growth, erect stems, and dense mostly terminal spikes stand in sharp contrast with the humifuse herbaceous stems and narrow, mostly long-pedunculate and leaf-opposed spikes of *D. pennellii*, the only other dalea known to extend (but at submontane elevations) along the Andes into extreme northern Chile (Tarapacá).

87. DALEA SMITHII (Macbride) Macbride
(Plate LXXXVII)

Suffruticose or weakly fruticose, erect or diffuse, 3.5–10 dm tall, the stramineous or livid-castaneous, rather densely tuberculate stems simple or subcorymbosely branching distally, the lower and older parts glabrous, the young branchlets at least thinly pilosulous with fine subappressed hairs up to 0.15–0.35 mm long, the foliage green, varying from glabrous to thinly pilosulous on both sides, densely punctate beneath; *leaf-spurs* 0.7–1.6 mm long; *stipules* narrowly lanceolate or subulate, ± 1.5–3 mm long, firm, dorsally glabrous or pilosulous, gland-charged, pilosulous within; *intrapetiolular glands* 2, often spiculiform; *post-petiolular glands* large and prominent, acute or mammiform, orange; *leaves* subsessile or shortly petioled, the main cauline ones 3–5 cm long, with narrowly green-margined, punctate rachis and 5–8 (9) pairs of oblanceolate to narrowly oblong-obovate, mostly obtuse to emarginate but often sharply gland-mucronulate, flat or loosely folded leaflets up to 6–12 mm long, the terminal one (of most leaves) shortly stalked, scarcely or not longer than last pair; *peduncles* 2–8 cm long; *spikes* relatively loose, ovoid-acuminate becoming long and narrow, without petals or androecia 10–12 mm diam, the ascending flowers (pressed) falling into ± 2–3 ranks and exposing parts of the densely pilosulous axis, this finally 3–15 cm long; *bracts* deciduous by full anthesis, (3.5) 4.2–7.5 mm long, the broadly

elliptic navicular body (2.5) 3.4–4.6 mm long, in profile 1.3–1.7 mm wide, broadly membranous-margined, toward the scarcely prominent keel livid and gland-sprinkled, dorsally puberulent overall or only at base, contracted into a livid subulate, internally puberulent tail 0.7–3 mm long; *calyx* 4.7–5.6 mm long, densely pilose-pilosulous with straight, rather stiffly ascending hairs up to 0.6–1.1 mm long, the tube (measured to dorsal sinus) 2.8–3.7 mm long, the orifice oblique, the slender castaneous (glabrous or pubescent) ribs becoming prominent, the flat (always pubescent) membranous intervals charged with 3–several small, 1-ranked or scattered glands, the triangular-acuminate, gland-spurred plumulose teeth a little unequal, the dorsal one longest, 1.5–2.4 mm long (0.7–2.2 mm shorter than tube); *petals* bicolored, usually all gland-tipped, the banner whitish, gland-sprinkled at eye, rubescent, the epistemonous ones vivid blue, perched low on androecium, 1–3 mm above hypanthium; *banner* (sometimes puberulent dorsally) 5.2–8.6 mm long, the claw 2.4–3.7 mm, the suborbicular blade 3.5–6 mm long, 3.6–6.8 mm wide, the (concolorous or blue) basal lobes incurved and adherent; *wings* 4.8–6.9 mm long, the claw 1.4–1.7 mm, the obliquely ovate blade 3.8–5.6 mm long, 1.9–2.8 mm wide; *keel* 7–9.2 mm long, the claws 2.4–2.8 mm, the blades 5–6.9 mm long, 3–4.3 mm wide; *androecium* 8.6–11.5 mm long, the longer filaments free for 3–4.5 mm, the connective gland-tipped, the anthers 0.75–0.8 mm long; *pod* ± 3.5 mm long, obtusely subisotriangular in profile, the valves hyaline in lower ½, thence thinly papery, pilose, gland-sprinkled; *seed* ± 2.6 mm long. — Collections: 12 (o).

Open stony hillsides and benches of barrancas, 2400–2960 m, inter-Andean valleys of s. Peru, on headwaters of Mantaro, Apurimac and Urubamba rivers in departments of Huancavelica, Apurimac, and Cuzco. — Flowering February to June. — *Representative*: HUANCAVELICA. Huancavelica: *Stork & Horton 10,913* (F, K, US). Castrovirreyna: *Angulo 3073* (US). APURIMAC. Abancay: *Univ. Cuzco 1263* (F). CUZCO. Calca: *Univ. Cuzco 687* (F, US). Urubamba: *Herrera 3421* (F); *D. Gade in 1964* (WIS).

Dalea smithii (Macbr.) Macbr., Candollea 7: 223. 1937, based on *Parosela smithii* (Albert Charles Smith, 1906–) Macbr., Candollea **5**: 370. 1934 ("*Smithii*"). — "Peru: Anco, Rio Mantaro Valley [Dept. Huancavelica, prov. Acobamba], 2500 m, April, 1929, *Killip & Smith 22180*..." — Holotypus, F! isotypi, NY, US!

Dalea pazensis var. *vargasii* (César Vargas Calderón, –) Macbr., Field Mus., Bot. **13**[3]: 372. 1943. — "Cuzco: Chicon Canyon, 2900 m., Vargas 11067..." — Holotypus, collected on Univ. Calif. Second Expedition to Andes, mar 7, 1939, F! isotypus, K!

In general aspect *D. smithii* closely mimics *D. pazensis*. The leaflets are ordinarily fewer by two or three pairs and the mature spike tends to be looser and narrower, but the only really decisive character, noted by Macbride in the case of his var. *vargasii*, is the deciduous bracts. It may be that excessive emphasis is being placed on this feature, but it is of such practical utility in the taxonomy of the Andean daleas that no excuses need be made. Although Macbride credited *D. pazensis* to Huancavelica, the species appears to be endemic to the eastern margin of the Bolivian Plateau, southward from the Titicaca Basin, whereas *D. smithii* has been found only on rivers flowing north to the Amazon in southern Peru.

The types of *D. pazensis* var. *vargasii* and *Parosela smithii* are interpreted as glabrate and pubescent phases of one species. The material from Dept. Cuzco has leaves of deep green color, the blades of the leaflets glabrous or only puberulent on the midrib beneath, and bracts pilosulous externally over nearly the whole surface. In Huancavelica the leaves are pubescent on both sides and the bracts glabrous beyond the base. But on the Apurimac, glabrous and moderately pubescent individuals are found close together. Racial

differentiation is probably active within *D. smithii*, but does not yet deserve taxonomic recognition. See also discussion of sympatric but obscure *D. antana* in Appendix I.

The basionym *Parosela smithii* Macbride (1934) being a later homonym of *P. smithii* Rydberg (1920), the binomial *Dalea smithii* is best interpreted as a new proposition dating from 1937.

88. Dalea pazensis Rusby
(Plate LXXXVIII)

Slender shrubs and subshrubs up to 0.6–2 m tall, often with a single trunk up to 8 mm diam, openly paniculate- or cymose-branching distally, the glabrate old wood brown and furrowed, the young leafy branches stramineous to pinkish-brown or livid-castaneous, at least distally charged with many low glands, finely pilosulous nearly throughout with narrowly ascending, subappressed, or sometimes a few irregularly spreading hairs up to 0.25–0.5 mm long, the foliage green or when young subcinerous, the leaflets pubescent both sides, often a little more densely above than beneath, closely punctate dorsally; *leaf-spurs* 0.6–2 mm long; *stipules* narrowly subulate, subsetiform, or narrowly lance-caudate, early becoming dry and fragile, (1.2) 2–4.5 (6) mm long, pilosulous at least within, commonly glandular externally; *intrapetiolular glands* 2, small but prominent, sometimes spiculiform; *post-petiolular glands* conic or prickle-shaped, prominent; *leaves* short-petioled, the main cauline ones (3) 4–8 cm long, drought-deciduous and often all lost from specimens at late anthesis, with narrowly margined, gland-sprinkled rachis and 7–11 pairs of oblong-elliptic to oblanceolate, obtuse or acute and sharply gland-mucronulate, flat or loosely folded leaflets up to (6) 7–13 (15) mm long, the leaves of barren or terminally flowering axillary branchlets shorter, with ± 4–8 pairs of smaller leaflets, the terminal one usually stalked and a trifle larger than the last pair; *peduncles* (0) 0.5–7.5 cm long; *spikes* moderately dense, in bud ovoid-pyramidal becoming cylindroid, amentiform, including bracts but without petals or androecia 10–14 mm diam, the ascending flowers loosely contiguous, the densely pilosulous axis becoming (1) 1.5–8 (14) cm long; *bracts* persistent, 4–6.5 mm long, subhomomorphic (the lowest sometimes firmer and longer-tailed), the ovate-oblong navicular body loosely clasping the calyx, 2.7–4 mm long, in profile (0.9) 1–1.8 mm wide, with broad hyaline glabrous base and margins, otherwise thinly papery, livid-greenish, dorsally pilosulous and charged with prominent orange glands, abruptly contracted or attenuate into a subulate livid pilosulous tail 1–2.5 mm long; *calyx* 4.6–5.5 mm long, densely pilose-pilosulous with narrowly ascending, straight lustrous hairs up to 0.6–1.2 mm long, the tube (measured to dorsal sinus) 2.8–3.4 mm long, its mouth strongly oblique, the ribs slender, usually livid or castaneous, rarely pallid, becoming prominulous, the broad, almost flat intervals charged with 1 (the ventral pair with 2) rows of 2–6 small yellowish or colorless glands, the teeth unequal, the narrowly triangular dorsal one 1.6–2.5 mm long (0.7–1.6 mm shorter than tube), the lateral and ventral pairs progressively shorter and more broadly triangular, all usually gland-spurred and lividly gland-tipped; *petals* bicolored, the banner white but bluish-tinged around lower margins of gland-sprinkled blade, early rubescent, the epistemonous ones vivid cobalt or indigo blue, sometimes charged with a few small glands, the keel gland-tipped, perched well below middle of androecium (1.8–2.6 mm above hypanthium); *banner* 6.6–7.6 mm long, the claw 3.2–3.6 mm, the broadly flabellate or suborbicular-cordate blade 3.2–4.8 mm long, 4–5.2

mm wide, at base open or nearly so, the lobes incurved and adherent to form lateral pockets; *wings* 5.3–6.1 mm long, the claw 1.7–2 mm, the obliquely ovate blade 4.2–4.6 mm long, 1.9–2.5 mm wide; *keel* 7.6–9 mm long, the claws 2.6–3.5 mm, the broadly ovate-elliptic blades 4.9–6.3 mm long, 2.9–3.8 mm wide; *androecium* 8.2–10.2 mm long, the longer filaments free for 2.2–3 mm, the connective gland-tipped, the pale bluish anthers (0.55) 0.6–0.8 mm long; *pod* almost exactly deltate in profile, isotriangular, ± 2.7 mm long, the prow subfiliform, the style-base at corner, the valves hyaline and glabrous in lower ½, thence papery, stramineous, pilosulous, gland-sprinkled; *seed* 1.9–2.1 mm long. — Collections: 25 (o).

Dry rocky hillsides and stony washes, mostly 2250–3000 m, locally abundant along the e. rim of the Bolivian Plateau in Dptos. La Paz (s.-ward from Sorata), Cochabamba, and Sucre, descending rarely along Río La Paz to the margins of Las Yungas at 1050 m. — Flowering October to June. — *Representative*: La Paz: *Mandon 699* (BR, F, K, NY, US, W); *Buchtien 554* (NY, US), *3194* (K, NY, US). Cochabamba: *Steinbach 8753* (F, K, NY, US); *Cárdenas 640* (US); *Balls 6227* (UC, US); *Eyerdam 24,867* (F, K, UC). Sucre: *Cárdenas 640* (NY).

Dalea pazensis (of La Paz) Rusby, Mem. Torrey Club **3**[3]: 18. 1893 (*Pazensis*"). — "Near La Paz, 10,000 ft., 1890 (678)." — Holotypus, collected by Miguel Bang, NY! isotypi, GH, K, NY (2 sheets), US! — *Parosela pazensis* (Rusby) Macbr., Contrib. Gray Herb., New Ser. **65**: 23. 1922.

Parosela oblongifolia (with oblong leaflets) Rusby, Mem. N. Y. Bot. Gard. **7**: 262. 1927. — "Espia 3500 feet, O. E. White, July 25, 1921 (*no. 608*)." — Holotypus, NY! isotypi, GH, US!

A slender shrub, prone to lose its primary foliage during anthesis, but attractive nevertheless because of its relatively long and loose catkin-spikes of vivid blue and white flowers. It is often associated with and in form, size and color of the bracts and flowers closely resembles *D. boliviana*, but is a more erect, distinctly fruticose plant with stems 6–20 (not 1–4.5) dm long, longer leaves (mostly 4–8, not 1–3 cm), and slightly more numerous (mostly 7–11, not 4–8) pairs of leaflets. In habit *D. pazensis* resembles the allopatric Peruvian *D. smithii*, but this is quickly distinguished by its deciduous interfloral bracts. In southern Bolivia its range approaches that of the largely Argentinian *D. elegans*, like it in persistent bracts but different in the more numerous (mostly 10–19, not 7–11) pairs of leaflets, of which the uppermost form with the odd one a palmate, not a pedate trefoil.

No marked variation can be recorded for *D. pazensis*. The type of *P. oblongifolia*, despite its origin on the east piedmont of the plateau more than 1000 meters below the main range of *D. pazensis*, does not differ materially. At Espia the species is associated with *D. carthagenensis* var. *pilocarpa*, which reappears at Sorata, again in company with *D. pazensis*, near 2600 meters. The species was collected first in 1846, by Thomas Bridges (K).

89. Dalea kuntzei Harms

(Plate LXXXV)

Slender, low, tortuously branching subshrubs up to 5 (?) dm tall, appearing glabrous up to the inflorescence but the stipules at least when young pilosulous and the leaf-rachis sometimes charged with a few weak scattered hairs, the old stems becoming striped and fissured, the livid young branchlets ± sparsely tuberculate, the thin and distant foliage dark green, the very narrow leaflets glabrous, strongly dotted beneath; *leaf-spurs* 0.4–0.8 mm long; *stipules* narrowly subulate, livid, 1.2–2.5 mm long; *intrapetiolular glands* minute; *post-petiolular glands* small but prominent; *leaves* shortly

petioled, the main cauline ones 2.5–4 cm long, with narrowly thick-margined, gland-dotted rachis and 4–7 distant pairs of linear-oblanceolate, obtuse or emarginate, folded or involute (thus apparently truly linear) leaflets (4) 5–12 (fide Ulbrich up to 18) mm long; *peduncles* few, terminal to leafy branchlets, 1.5–4 cm long; *spikes* moderately dense, ovoid or ovoid-oblong, without petals 10–12 mm diam, the pilosulous axis 0.7–2.5 cm long; *bracts* persistent, 4–6 (6.5) mm long, the navicular, dorsally keeled body 3.5–4.5 (5) mm long, in profile ± 1.2 mm wide, distally and medially firm and livid-striate or -suffused, dorsally gross-glandular and pilosulous along keel, at least below middle, glabrous within, contracted into a subulate, internally pilosulous tail ± 1 (1.5) mm long; *calyx* 5–6 mm long, pilose throughout with fine ascending spiral hairs up to 0.8–1.2 mm long, the tube (measured to dorsal sinus) 2.9–3 mm, recessed behind banner and the orifice strongly oblique, the livid-castaneous ribs not very prominent, the membranous intervals charged with 1 row of ± 3 yellow or livid blister-glands, the triangular-acuminate, gland-spurred teeth unequal, the dorsal one 2–2.8 mm long (almost as long as to 1 mm shorter than tube), the ventral pair shortest; *petals* bicolored, the banner creamy-white except for basal lobes, rubescent, charged near eye with a few small glands, the epistemonous ones amethyst-purple, their outer margins whitish (when dry yellowish), perched low on androecium (1.2–1.7 mm above hypanthium), all but the wings gland-tipped; *banner* 7 mm long, the claw 2.8–2.9 mm, the broadly ovate, obtuse, hooded blade 4.6–4.9 mm long, 3.7–3.9 mm wide, recessed at base into a cornet and the basal lobes incurved and adherent to form lateral pockets; *wings* 5.5–5.8 mm long, the claw 1.8–2 mm, the lance-oblong blade 4.2–4.4 mm long, 1.7–2.1 mm wide; *keel* 8–8.7 mm long, the claws 2–2.4 mm, the blades 6.3–6.5 mm long, 3.1–3.2 mm wide; *androecium* 10-merous, 7.2–8 mm long, the longer filaments free for 2.7 mm, the connective gland-tipped, the anthers 0.8–1 mm long; *pod* in profile deltate, 3–3.3 mm long, the style base at one corner, the prow slenderly keeled, the valves membranous in lower ½, thence firm, densely pilosulous, charged with small, evenly spaced glands. — Collections: 2 (o).

Arid stony hillsides, 1000–1800 m, apparently local, known only from the e. slope of Cordillera Oriental in Santa Cruz, Bolivia. — Flowering March to June. — *Material*: BOLIVIA. SANTA CRUZ: Mairana, *Steinbach 8297* (F, NY).

Dalea kuntzei (K. E. O. Kuntze, 1843–1907) Harms ap. O. Kuntze, Rev. Gen. **3**[3]: 59. 1898. — "Bolivia: 1000 m Sierra de Santa Cruz." — Holotypus, collected by Otto Kuntze in May, 1892, formerly B, survives as *Field Neg. 2035*! isotypi, F, NY (2 sheets, herb. Kuntz.)! — *Parosela kuntzei* (Harms) Macbr., Field Mus., Bot. **4**: 112. 1927.

Dalea rubricaulis (red-stemmed) Ulbr., Meded. Rijks Herb. Leiden **27**: 50. 1915. — "An sonnigen Felsen im Tal des Rio de la Vieja, 1750 m (no. 1711a — bl. im März 1911)." — Holotypus, collected by Theodor Herzog, formerly B, survives as *Field Neg. 733* (numbered by Macbride *1711*, not *1711a*)! — *Parosela rubricaulis* (Ulbr.) Macbr., Field Mus., Bot. **4**: 112. 1927 (non *P. rubricaulis* Rusby, 1910).

Harms rather ludicrously compared *D. kuntzei* with the North American annual *D. filiformis*; both have narrow leaflets but otherwise are worlds apart. In the form of the inflorescence and in petal-color *D. kuntzei* is essentially like *D. elegans* var. *elegans*, which represents the genus at similar elevations in the Andean foothills of northwest Argentina, and is probably closely akin to it, although the few pairs of long, very narrow leaflets are amply distinctive. Its nearest neighbor in Bolivia is *D. pazensis*, found mostly above 2000 m along the plateau rim; this has only slightly more numerous but always expanded leaflets, and vivid blue and white flowers.

Macbride (1943, p. 373) listed the certainly synonymous *D. rubricaulis* Ulbr. from Arequipa, Peru; the description associated with this reference belongs to *O. kuntzei*, but the locality and the specimen cited belong with an earlier homonym *P. rubricaulis* Rusby (= *D. cylindrica* fma., q. v.).

90. Dalea elegans Gillies
(Plate LXXXIX)

Herbaceous, suffruticose, or softly shrubby, variable (acc. to variety) in stature, (1) 1.5–12 dm tall, the stramineous, castaneous, or livid-purple stems densely tuberculate, either simple and monocephalous or subcorymbosely branched beyond middle, appearing glabrous up to the silky-barbate spikes but the stems at least when young and distally, the stipule-tips, and leaf-rachis (sometimes also the leaflets beneath) thinly pilosulous with weak spreading or sinuously subappressed hairs up to 0.15–0.8 mm long, the foliage green or subglaucescent, punctate beneath; *leaf-spurs* 0.4–1 mm long; *stipules* narrowly subulate, lance-caudate, or flexuously linear-setiform, (1.5) 2–8 mm long, glandular dorsally, pilosulous within; *intrapetiolular glands* 2, small, obtuse; *post-petiolular glands* prominent, a little larger; *leaves* subsessile or very short-petioled, the main cauline ones (1) 1.5–5 cm long, with narrowly margined, punctate rachis and (8) 10–16 pairs of gland-crenulate leaflets variable (acc. to variety) in size and texture, the upper rameal or spur-leaves, if present, shorter, with only (5) 7–11 pairs of smaller leaflets; *peduncles* (0.5) 1–7.5 cm long; *spikes* many-flowered, moderately dense, ovoid becoming oblong-cylindroid, without petals or androecia 10–14 mm diam, the flowers (pressed) falling into ± 3 ranks and exposing at least part of the pilosulous axis, this becoming 1–8 cm long; *bracts* persistent, (3.5) 4–7.3 mm long, the oblong-obovate or -elliptic, navicular body (2) 2.3–5 mm long, in profile (0.8) 1–1.6 mm wide, broadly scarious-margined in lower ⅔, livid-keeled and livid-glandular distally, either glabrous or pilosulous dorsally, ciliolate toward tip, contracted into a subulate livid inwardly pilosulous tail (0.7) 1.5–3 mm long; *calyx* 4.3–6.9 mm long, densely pilose-pilosulous with straight ascending hairs up to 0.4–1.2 mm long, the tube (measured to dorsal sinus) 2.7–3.4 mm long, the orifice oblique, the slender, commonly livid-nigrescent ribs little prominent, the flat membranous intervals charged with 1 (or the ventral pair with ± 2) rows of 3–8 minute, yellowish or transparent glands, the deltate to narrowly triangular-acuminate, minutely gland-spurred teeth unequal, the dorsal one 1.6–3.3 mm long (0.6–3.6 mm shorter than tube), the ventral pair shortest and broadest; *petals* variable (acc. to variety) in color, largely either bright blue or amethyst purple, the banner usually, the keel often, the wings rarely charged with small subapical glands, the blade of banner gland-sprinkled in eye, glabrous dorsally, the epistemonous petals perched low on androecium (± 1.2–2.3 mm above hypanthium; *banner* 6.4–8.3 mm long, the claw 2.7–3 mm, the deltate-cordate or suborbicular-flabellate, emarginate blade 4.1–5.2 mm long, 4.4–5.6 mm wide; *wings* 5.2–7 mm long, the claw 1.4–2.4 mm, the obliquely ovate or oblong-ovate blade 3.6–5.3 mm long, 1.9–2.8 mm wide; *keel* 8.4–9.7 mm long, the claws 2.7–4 mm, the broadly ovate-elliptic blades 5.5–6.7 mm long, 3–3.8 mm wide; *androecium* 10-merous, 8–10.3 mm long, the longer filaments free for 2.6–4.4 mm, the connective gland-tipped, the anthers 0.65–0.9 mm long; *pod* (little known) in profile obliquely triangular, 2.6–3 mm long, the style-base latero-terminal, the prow slenderly keeled, the valves hyaline in lower half, thence papery, sparsely gland-sprinkled, pilosulous; *seed* ± 1.6–2.1 mm long.

In the context of its Andean relatives, the notable feature of *D. elegans*, sens. lat., is the high number of leaflets, ten to sixteen pairs in most primary cauline leaves. Only the naturalized annual *D. leporina* can match it in this respect. In arrangement and form of the flowers *D. elegans* closely resembles the Bolivian *D. pazensis* and *D. kuntzei*; it seems likely that these three species, which have preserved so many common charactersitics while attaining vicariant ranges, are derived from a common source. The only perennial native dalea entering the range of *D. elegans* is the high-montane *D. boliviana*, a smaller, humifuse plant with much shorter and simpler leaves.

As defined herein, *D. elegans* is a polymorphic species, variable in stature, in amplitude of foliage, in pubescence, and in petal color. Burkart (1952, p. 253, fig. 66) recognized for Argentina, within the same span of variation, two major species, *D. elegans* sens. str. and *D. onobrychioides*, distinguished primarily by stature and size of leaflets, but these differences correlated with dispersal and ecology. The material that I have seen can generally be sorted neatly into categories, but there are difficulties: the ranges overlap in Salta, and there are disturbingly transient forms in southern Bolivia which cannot be ignored. Following Burkart with these reservations, it is possible to define a relatively low-growing, xerophytic var. *elegans* with short, crowded leaves, small, fleshy, folded leaflets, and petals of a reddish or amethystine purple (the banner mostly white in bud); and a taller, paniculately branching var. *onobrychioides*, characterized by expanded foliage of thinner texture and violet-blue petals (the banner concolorous distally). The former is proper to the arid sierras rising from the pampas east of the Andes proper; it ranges, mostly below 1900 m, from north-central San Luis through Sierra de Córdoba and reappears near Salta. From Salta northward, mostly at and above 2000 m, according to Burkart in more mesic environment, the species is represented by var. *onobrychioides*. Where this enters southern Bolivia, in Tarija, it has been redescribed as *Parosela eosina*. The type-collection of the latter shows in one and the same plant the low growth and small leaflets of var. *elegans* combined with the blue-violet petals of var. *onobrychioides*, but a second collection from the same region (Narváez near Tarija, 2800 m., *Cárdenas 4941*, US) retains the diffuse habit of var. *elegans* with the flat leaflets and flowers of var. *onobrychioides*. It appears that *D. elegans* preserves the habital plasticity which is so often encountered among its Peruvian kindred.

Key to the Varieties of *Dalea elegans*

1. Stems relatively long, erect or less often diffuse, 6–12 dm long, paniculately branching distally, each primary axis developing 5–11 flower-spikes; *leaflets* flat or loosely folded, relatively thin-textured, some up to 5–10 (12) mm long; *petals* blue, the banner concolorous except for a pale eye, the blade commonly appendaged at throat (the cornet well developed); mostly above 2000 m; e. slope of Argentine Andes in Tucumán, Salta, and Jujuy, n. just into Tarija, Bolivia.
   90a. var. *onobrychioides*.
1. Stems relatively short, erect or incurved-ascending, mostly 1.5–6 dm long, monocephalous or developing 2–4 lateral flower-spikes; *leaflets* closely folded, thick-textured, up to 5 (7) mm long; *petals* bicolored, the banner white with purple corners, its blade open or nearly so at throat, the epistemonous ones amethystine purple; mostly below 1950 m; Andean foothills and drier detached ranges in Córdoba and n.-w. San Luis, apparently disjunct in centr. Salta, Argentina.
   90b. var. *elegans*.

90a. DALEA ELEGANS Gillies var. ONOBRYCHIOIDES (Grisebach) Barneby (Plate LXXXIX)

Primary cauline leaves mostly 3.5–5 cm long; *spikes* mostly 4–8 or (acc. Burkart, 1952, p. 253) up to 18 cm long; *dorsal calyx-tooth* mostly 1.6–2.4 mm long. — Collections: 10 (o).

Meadows and brushy mountain slopes, 2000–3000 m, e. slope of Andes in n.-w. Argentina (Tucumán, Salta, Jujuy) and extreme s.-e. Bolivia (Tarija). — Flowering January to March. — *Representative*: BOLIVIA. TARIJA: *Pearce in 1864* (K); *Cárdenas 4941* (US). ARGENTINA. JUJUY: *Burkart & Troncoso 11,259* (US). SALTA: *Sleumer & Vervoorst 2792* (UC, US); *T. Meyer 4839* (NY, UC); *Lorentz & Hieronymus 537* (F, US, formerly B = *Field Neg. 2038*). TUCUMÁN: *Venturi 2916* (NY, UC, US), *3574* (F, US).

Dalea elegans Gill. var. **onobrychioides** (Grsb.) Barneby, stat. nov., based on *D. onobrychioides* (like sainfoin) Grsb., Abh. Wiss. Götting. **19**: 119 [Pl. Lorentz. 70]. 1874 — "210...Tucuman, in fruticetis jugi Cuesta de Siambon." — Holotypus not examined; *Venturi 2916* from Cumbres de Anfama = approximate topotypus! — *Parosela onobrychioides* (Grsb.) Macbr., Field Mus., Bot. **4**: 109. 1927.

Parosela eosina (eosin-stained, reddish) Macbr., Field Mus., Bot. **4**: 109. 1927. — "BOLIVIA: Tucumilla, near Tarija, November 30, 1903, *Fiebrig 2442*." — Holotypus, GH! isotypi, F (2 sheets, dated Dec 30), K, US! — *Dalea eosina* (Macbr.) Macbr., Candollea **7**: 222. 1937.

The holotypus of *D. onobrychioides* should be sought at GOET but the protologue is definitive. Grisebach sent to Hooker at Kew a part of *Lorentz & Hieronymus 537* from Salta, identified as his species, and at the same time redescribed *D. elegans*, the only possible alternative, as *D. stenophylla*. The variety was collected first by Pearce, in Bolivia just north of the Argentine boundary (e. of Mecoya), in 1864.

90b. DALEA ELEGANS Gillies var. ELEGANS (Plate LXXXIX)

Primary cauline leaves mostly 1–3.5 cm long; *spikes* mostly 1–5 (7) cm long; *dorsal calyx-tooth* mostly 2–3.3 mm long. — Collections: 15 (o).

Dry rocky hillsides and outwash slopes, ± 1050–2000 m, along the e. piedmont of the Argentine Andes from Sierra del Morro in e. San Luis, n. through Sierras Grande and Chica in Córdoba; apparently disjunct in Salta (Depto La Candelaria). — Flowering December to March. — *Representative*: SALTA: *Schreiter 9235* (F, UC, US). CÓRDOBA: *Burkart 7405* (F); *Ledingham & Hunziker 4482, 4485* (NY); *Goodspeed 17,235* (UC); *Genevieve Dawson 77* (NY).

Dalea elegans (elegant) Gill. ex H. & A. in Hook., Bot. Miscell. **3**: 183. 1833. — "El Cerro del Morro (Prov. of San Luis), *Dr. Gillies*." — Holotypus, K (herb. Hook.)! isotypus (*Gillies 263*), OXF!

Dalea stenophylla Grsb., Abh. Wiss. Götting. **19**: 118 [Pl. Lorentz. 69] 1874. — "209.... Cordoba, in regione superiori Sierra de Cordoba pr. S. Bartolo." — Holotypus, presumably GOET, not examined; isotypus formerly B survives, with fragm. (F) as *Field Neg. 2040*!

The xerophytic counterpart of var. *onobrychioides*, occupying a lower, dryer belt along the foothills of the eastern cordilleras. Burkart (1952, p. 253) has already correctly equated *D. stenophylla* with *D. elegans*, but cites the latter only from Sierras de San Luis and Cór-

doba. The cited collection from Salta (Cuesta de Muquillo, dep. La Canderlaria) is entirely typical of var. *elegans*, even to flower-color, noted by the collector as *rosada*. Burkart (1952) has pointed out that it is the close folding of the leaflets that makes them appear so narrow; but they are also smaller and more fleshy than those of var. *onobrychioides*.

91. DALEA BOLIVIANA Britton
(Plate LXXXVIII)

Diffuse or prostrate herbs, the stramineous, low-tuberculate (or under the spikes densely verruculose), simple and monocephalous or distally few-branching stems (0.5) 1–4.5 dm long, radiating from a woody root or sometimes thickened and knotty caudex, appearing glabrous to the inflorescence, sometimes truly so, but the young stems, the leaf-stalks, and sometimes the midrib or margins or lower face (or some of them) of the leaflets thinly pilosulous with ascending hairs up to 0.2–0.55 mm long, the nodes of young shoots sometimes woolly-villosulous, the thick-textured foliage pallid-green or glaucescent, the leaflets smooth above, punctate beneath; *leaf-spurs* 0.4–0.9 mm long; *stipules* narrowly lanceolate to subulate, 1–3.5 mm long, pallid or commonly livid-castaneous, usually ciliolate; *intrapetiolular glands* 2, impressed; *post-petiolular glands* a little larger, prominent; *leaves* sessile or short-petioled, the main cauline ones 1–3 cm long, with margined, ventrally grooved rachis and (3) 4–8 (9) pairs of either distant or crowded, broadly oblong-obovate, obovate-emarginate, or deeply obcordate, loosely folded or flat and marginally elevated, dorsally keeled leaflets up to (2) 2.5–6 (7) mm long; *peduncles* 1–5 (6) cm long; *spikes* moderately dense, the flowers subcontiguous but (pressed) not fully concealing the axis, at first bluntly ovoid becoming oblong or finally cylindroid, without petals 8–12 mm diam, the pilosulous axis becoming (1) 1.5–6 (7) cm long; *bracts* persistent, clasping the buds and base of mature calyces, subhomomorphic (the lowest, especially of aborting buds, relatively firm and narrow), the majority 3.5–5.5 mm long, the body elliptic-obovate, navicular, 3–4.5 mm long, in profile 1.1–1.7 mm wide, with broad pallid scarious margins and firm greenish or livid keel and tip, dorsally glabrous or thinly pilosulous, glandular, often ciliolate distally, contracted or attenuate into a firm livid nearly always pilosulous tail 0.5–2 mm long; *calyx* 4.3–6.1 mm long, softly densely pilose-pilosulous with ascending, finally spreading hairs up to (0.5) 0.6–1.2 mm long, the tube 3–4 mm, oblique at orifice, the slender, concolorous or livid ribs becoming prominulous, the membranous intervals charged with 1 row of 3–4 small distant glands commonly visible only from within, the teeth unequal, triangular-cuspidate, green or livid, gland-spurred, the dorsal one 1.2–2.3 mm long (1.2–2.2 mm shorter than tube), the ventral pair shortest and broadest; *petals* bicolored, the banner white with often colored basal lobes, often gland-sprinkled in the eye, rubescent, the epistemonous ones bright blue or amethystine-violet, often pallid along outer edges, gland-tipped or not, perched well below middle of hypanthium (1.6–2.6 mm above hypanthium); *banner* 5.1–8.5 mm long, sometimes as long as detached keel, commonly a little shorter, the claw (1.9) 2.2–4 mm, the deltate-cordate blade (3) 3.8–5.1 mm long, (3.2) 4.2–5.2 mm wide, open at base but the lobes ± adherent laterally; *wings* 4.7–6.9 mm long, the claw 1.6–2.6 mm, the blades 3.1–4.8 mm long, 1.6–2.5 mm wide; *keel* (6.8) 7–9.5 mm long, the claws (2.3) 2.5–3.6 mm, the blades (4.3) 4.5–6.4 mm long, (2.8) 3–4 mm wide; *androecium* 6.5–11 mm long, the longer filaments free for 2.2–3.4 mm, the connective gland-tipped, the anthers 0.7–1.05 mm long, the five alternate ones sometimes much smaller; *pod* 2.6–3 mm long, essentially as in *D. exilis*. — Collections: 40 (o).

Stony steppes and open rocky hillsides, 2500–4000 m, widely dispersed and locally common on the Andean Plateau e. of the Divide, from the headwaters of the Apurimac-Montaro in Ayacucho and Cuzco, Peru, s.-e. (common) through Bolivia (La Paz, Cochabamba, Sucre) into Jujuy, Argentina, and on, apparently rarer, to w. Tucumán (Tafi) and Catamarca (Andalgalá). — Flowering mostly February to May, in Peru sometimes into July. — *Representative*: PERU. AYACUCHO: *Weberbauer 5526* (F, US); *J. West 3661* (UC). CUZCO: *Hill 137* (K); *Herrera 3042* (F); *Soukup 404* (F). BOLIVIA. LA PAZ: *Bang 106* (F, K, NY, US); *Buchtien 134* (F, NY), *555* (F, NY, US). COCHABAMBA: typus of *D. retusifolia*. SUCRE: *Hammarlund 385* (NY). POTOSÍ: *Balls 6060* (K). ARGENTINA. JUJUY: *Venturi 4960* (F, UC, US), *6620* (US), *8725* (K, US), *9357* (K, US); *Balls 5971* (F, K, UC, US). SALTA: *Venturi 6856* (US). TUCUMÁN: *Venturi 6619* (US). CATAMARCA: *Sleumer 2743* (US); *Jorgensen 1629* (US).

Dalea boliviana (of Bolivia) Britt., Bull. Torrey Club **16**: 259. 1889 ("*Boliviana*"). — "Near La Paz...*Rusby 959*." — Holotypus, collected in Apr. 1885, NY! isotypi, F, GH, K, NY (2 sheets), US (2 sheets)! — *Parosela boliviana* (Britt.) Macbr., Contrib. Gray Herb., New Ser. **65**: 23. 1922.

Dalea retusifolia (with notched leaflets) Harms ap. O. Kze., Rev. Gen. 3^2: 59. 1898. — "Bolivia: Tiraqui." — Holotypus, collected by Otto Kunze, Apr 1–4, 1892, at 3600 m, near Tiraque, dept. Cochabamba, formerly B, survives as *Field Neg. 2041*! isotypus, NY (herb. Kze.)!

Dalea hofstenii (G. von Hofsten, accompanied Fries in Argentina) R. E. Fries, Nov. Act. Soc. Sci. Upsal. IV, **1**: 132. 1905. — "Prov. Jujuy: Yavi, 3400 m.s.m. (2 Jan., 1902; Fr. 777); Cochinoca, ca 3300 m.s.m. (10 Febr. 1901; Kurtz 11635); Moreno in montibus saxosis, 3500 m.s.m. (15 Dec., 1901; Fr. 927). — Holotypus (U), not examined; paratypus, *R. E. Fries 927*, US! — *Parosela hofstenii* (R. E. Fries) Macbr., Field Mus., Bot. **4**: 108. 1927.

Dalea calliantha (with pretty flowers) Ulbr., Feddes Repert. **2**: 11. 1906. — "Austro-Bolivia: Prope Puna Patanca...3800 m.s.m. (K. Fiebrig; Plantae austro-bolivienses 1903 bis 1904 No. 3189 legit 26. III. 1904.)." — Holotypus, formerly B, survives as *Field Neg. 2032*! isotypi, F, GH, K, US! — *Parosela calliantha* (Ulbr.) Macbr., Contrib. Gray Herb., New Ser. **65**: 23. 1922.

Parosela boliviana var. *herrerae* (Fortunato Luciano Herrera y Garmendia) Macbr., Field Mus., Bot. **4**: 106. 1927. — "PERU: ...San Sebastian, Dept. of Cusco, April 25, 1925, *Pennell 13602*..." — Holotypus, F! phototypus, *Field Neg. 50,193*! paratypi, *Herrera in 1923*, *Cook & Gilbert 322*, from Cuzco and Ollantaytambo respectively, both US!

Southward from Ayacucho in Peru *D. boliviana* is the only high Andean dalea with short (1–4.5 dm) prostrate stems from a perennial root-crown or shortly forked woody caudex. Through its range it is associated successively with *D. smithii* in Peru, *D. pazensis* in Bolivia, and *D. elegans* in extreme southern Bolivia and Argentina; all of these are normally taller plants, or suffruticose, or if no taller then erect, and distinguished further, if habit is in doubt, by more numerous and longer leaflets. The habitally similar but apparently annual *D. tapacariensis*, known from only one station in Cochabamba, has smaller flowers with only the wing-tips blue. At its north limit *D. boliviana* is not too clearly distinguished from *D. exilis* (see discussion of that species); but with the possible exception of *D. tapacariensis* it has no close relative southward from Lago Titicaca.

The complex synonymy attributed to *D. boliviana* suggests a species much more variable than is actually the case. In the Titicaca basin, the type-region, the larger cauline leaves are 2 cm long or more and composed of some 6–8 pairs of oblong-obovate, truncate-emarginate but usually not deeply retuse leaflets glabrous except for a few hairs along the margins and dorsal keel; and the epistemonous petals are normally vivid cobalt blue.

Macbride segregated from this a Peruvian var. *herrerae*, supposed to differ from the Bolivian type in being more nearly glabrous. We now have ample material both from the Vilcanota valley around Cuzco and from La Paz, and find no substantial difference in vesture. The collections of var. *herrerae* from Ayacucho, here referred to *D. boliviana* because of the large calyx and petals, are on the other hand suggestive of passage into the vicariant *D. exilis*; among other things they are intermediate in size of anthers (0.5–0.7 mm long). In southern Bolivia and Argentina the average larger cauline leaves of *D. boliviana* become shorter (1–2 cm) and more condensed, with fewer (3–6) pairs of abbreviated and broadly obovate-obcordate, widely and deeply retuse leaflets, and the epistemonous petals are amethystine purple, of the same or nearly the same color as those of *D. elegans* var. *elegans*. In this area the stipules, also, tend to be shorter and relatively broader than in populations around La Paz. Leaflets of the broader retuse type may be, just like the obovate leaflets northward, either glabrous or thinly pilosulous dorsally, and are not consistently fewer, nor reliably correlated with petal-color. At La Paz itself Buchtien collected two otherwise identical examples of *D. boliviana* in one locality, carefully noting the petals of one (*no. 31*, US) as "violett" and of the other (*no. 32*, US) as "blau". Moreover at the northwest limit of *D. boliviana* in Ayacucho the leaflets become as few as in Argentina but retain the outline of the common north Bolivian phase. Even in Jujuy the short, obcordate leaflet, although certainly prevalent, is not truly constant (cf. *Venturi 4960*, US). I am therefore unable to follow Burkart (1952, p. 253) in recognizing *D. hofstenii* as a discrete species, even though it corresponds with a fairly well-marked geographic trend. Except for leaflet-number, no serious differential character has ever been attributed to *D. retusifolia, D. hofstenii* or *D. calliantha*. Harms, deploring the lack of a generic monograph, compared *D. retusifolia* with the totally unlike and unrelated *D. enneaphylla* W., noting however that it seemed to differ from *D. boliviana* in a longer calyx (untrue) and purple petals (a point discussed above). The type-collection of *D. calliantha* is a series of starved plants gathered at early anthesis, apparently from an exceptionally arid or exposed habitat. The type-locality is in extreme southern Bolivia south of Tarija, where the variant described independently as *D. hofstenii* becomes common.

This species was collected first in 1864, by the Veitch collector Richard Pearce (K).

92. Dalea exilis DeCandolle

(Plate XC)

Prostrate herbs, with several or many slender flexuous microtuberculate stems (1) 1.5–6 (7) dm long arising from the root-crown or from a shortly forked caudex, these simple only when short, usually branching from middle upward or only distally, green or purplish, glabrous or (especially upward) thinly pilosulous with sinuous subappressed or weak spreading hairs up to 0.2–0.6 mm long, the spikes mostly terminal to leafy branchlets, the foliage glabrous or nearly so, green or greenish-glaucescent, the leaflets sometimes thinly ciliolate on margins and dorsal keel, smooth above, gland-sprinkled beneath (some glands often exactly marginal and impressed-crenulate); *leaf-spurs* 0.5–1.4 mm long; *stipules* narrowly lanceolate to linear-subulate or -caudate, 1.5–5 mm long, thinly pilosulous towards tip; *intrapetiolular glands* 2 minute impressed; *post-petiolular glands* small, prominent but mostly blunt; *leaves* subsessile or shortly petioled, the primary cauline ones 1.5–4.5 cm long, with narrowly green-margined rachis and (4) 5–8 (9) pairs of oblanceolate to oblong-oblanceolate, commonly open-emarginate, rarely short-acuminate, always gland-mucronulate, flat to loosely folded or marginally involute leaflets up to 2.5–6 mm long, the terminal one (of most leaves) very shortly stalked, the leaves of subradical and axillary spurs (when

present) smaller and shorter, with mostly 3–5, rarely 2 pairs of smaller leaflets; *peduncles* (1) 2–7 cm long; *spikes* incurved to vertical, moderately dense but not cone-like, ovoid becoming oblong or oblong-cylindroid, without petals (but including bracts) 7–10 mm diam, the pilosulous axis (0.5) 1–6 cm long; *bracts* persistent, homomorphic or the lowest (subtending sterile buds) sometimes firmer and narrower than the rest, 3–5 (5.5) mm long, the broadly ovate, obovate, or oblong-obovate, navicular body 2.2–3.7 mm long, in profile 1–1.5 mm wide, pallidly scarious except for the livid keel and a green or livid patch above middle, charged dorsally with many small yellowish blister-glands, glabrous or nearly so, contracted into a subulate, livid, glabrous or thinly pilosulous tail 0.3–1.8 (3) mm long; *calyx* (3) 3.4–4.4 mm long, pilosulous with ascending hairs up to 0.4–0.6 (0.8) mm long, the tube (measured to dorsal sinus) 2.2–3.1 mm long, the slender ribs green or livid, the hyaline intervals charged with 1 row of tiny (often scarcely visible) honey-colored glands, the orifice strongly oblique, the triangular-subulate or deltate-apiculate gland-spurred and -tipped teeth slightly unequal, the dorsal one 0.7–1.4 (1.6) mm long, the ventral pair a trifle broader; *petals* bicolored, the banner white with blue-tipped lobes, sometimes gland-sprinkled in the greenish eye, rubescent, the banner and keel sometimes tipped with a small gland, the epistemonous ones vivid blue or violet-blue, perched below middle of androecium (± 1.2–2 mm above hypanthium); *banner* 4.5–6.2 mm long, the claw (1.7) 2–3.3 mm, the deltate-ovate somewhat hooded blade 2.6–3.5 mm long, 2.4–3.6 mm wide, open at base but the lobes incurved and adherent to form obscure lateral pockets; *wings* 3.3–4.4 mm long, the claw 1.1–1.7 mm, the blades 2.1–3 mm long, 1.2–1.5 mm wide; *keel* 4.6–6.3 mm long, the claws 1.4–2.5 mm, the blades 3–4.2 mm long, 1.9–2.5 mm wide; *androecium* 10-merous, 5–7.6 mm long, the longer filaments free for 1.4–2.4 mm, the connective minutely gland-tipped, the bluish anthers (0.3) 0.35–0.55 mm long; *pod* 2.5–2.9 mm long, in profile obovate-deltate, the very short style-base at or just below the adaxial corner, the prow filiform, the valves hyaline in lower half, thence thinly herbaceous, finally papery, gland-sprinkled, thinly pilosulous; *seed* (seldom seen) ± 2 mm long. — Collections: 20 (o).

Open stony slopes, sometimes among brush, along roadsides or in thin pastures, 2100–3500 m, apparently not uncommon in intermontane valleys of the Peruvian Andes from s. Amazonas and s. Cajamarca s. to Junín, extending feebly to the Pacific slope in s. Ancash (prov. Bolognesi) and Lima (prov. Canta, Huarochirí), passing s.-e. along upper Mantaro valley in Huancavelica into *D. boliviana*. — Flowering March to May. — *Representative*: AMAZONAS. Chachapoyas: *Wurdack 645* (F, NY, K, UC, US). CAJAMARCA. Cajamarca: *Ferreyra 3169* (US); Celendín: *Hutchinson & Wright 5142, 5261* (NY). ANCASH. Bolognesi: *Ferreyra 5635, 7458* (US). Huaraz: *Ferreyra 14,646* (REGINA). PASCO. Daniel Carrión: *Macbride & Featherstone 1167* (F). LIMA. Huarochirí: *Macbride & Featherstone 301* (F). Canta: *Mathews 552* (OXF). HUÁNUCO. Ambo: (typus of *D. peruviana*). Huánuco: *Macbride 3507* (F). JUNÍN. Tarma: *Killip & Smith 21,790* (US); Junín: *Killip & Smith 22,028* (US), *Soukup 1890* (US). HUANCAVELICA. cf. discussion infra.

Dalea exilis (meagre) DC., Prod. **2**: 247. 1825. — "...in Peruvia." — Holotypus, labelled "Pérou, *Pavon*", G-DC! — The specimens from Huánuco, *Ruiz & Pavón in 1778–88* (F) are only possibly isotypic. — *Parosela exilis* (DC.) Macbr., Field Mus., Bot. **4**: 103. 1927.

Parosela peruviana Macbr., Field Mus., Bot. **4**: 106. 1927. — "PERU: ...Ambo, Dept. of Huanuco, April 5, 1923, *Macbride 3193*..." — Holotypus (F), not examined; isotypus, US! phototypus, *Field Neg. 50,208*, F! — *Dalea peruviana* (Macbr.) Macbr., Candollea **7**: 223. 1937.

A diffuse herbaceous dalea with neat green foliage and prolific but small, vivid blue and white flowers, *D. exilis* can be visualized as either a diminished version of the related but more southern *D. boliviana*, or alternately as a glabrescent or even glabrous and ampler one of the more northern *D. humifusa*. Collectively these three species form an almost uninterrupted series of variants extending along the Andes from central Ecuador to Catamarca in Argentina, and might logically be treated as substantial geographic expressions of one species. The extreme forms, however, are so different in gross appearance that it seems more practical to follow tradition and recognize three major divisions at the level of species, always bearing in mind that on the common frontiers of their ranges vexatious morphological intermediates will present a problem of identity. Forms intermediate between *D. exilis* and *D. humifusa* are mentioned under the latter species; others linking *D. exilis* with *D. boliviana* are known from the Mantaro valley in Huancavelica and from Cuzco. In both these provinces there occur individual plants combining the slender branched habit of *D. exilis* with flowers in one feature or another too large for that species yet too small for ideal *D. boliviana*. It is impossible to believe that *Tovar 166* (US) from near Conaica in Huancavelica is specifically distinct from the essentially typical *D. exilis* that occurs in neighboring Junín and Huánuco; yet its calyx is much too large to fit comfortably into my concept of *D. peruviana* and the plant-body is scarcely different from that of, for example, *Cook & Gilbert 322* (US) from Ollantaytambo in the canyon of Río Urubamba in Cuzco, a plant that I take to be good *D. boliviana* var. *herrerae*, a concept that coincides rather neatly with the critically intermediate material.

Variation within *D. exilis* as defined above is most noticeable in pubescence and size of flower. The smallest flower coincides with the northern limit of the species in Amazonas, where the species most nearly approaches the yet smaller-flowered *D. humifusa*; the largest, as mentioned already, where its range abuts on that of *D. boliviana*. Northward the plants are almost glabrous up to the spikes, or at least appear so to the unaided eye; southward the young stems and the leaflets tend to be more or less hairy, usually with very short subappressed trichomes, but sometimes, as in the type-collection of *D. peruviana*, with weak, relatively long, horizontally spreading ones. These are interpreted as minor variants of a type to be expected in all widely dispersed species of *Dalea*.

Interpretation of the holotype of *D. exilis* has presented all students of the genus with a difficult problem, partly because it is rather fragmentary and also immature, but more importantly for this reason: the flower stands near the large extreme admissible to *D. exilis*, close to the small extreme of *D. boliviana*, while the foliage might represent either species. Macbride (1943, p. 365, 368) suspected that *D. exilis* was *D. boliviana*, but maintained it nevertheless as distinct both from *D. boliviana* and from *D. peruviana*, although still known only from the type-collection. The relatively narrow lower bracts seen on one of the two spikes in the Prodromus herbarium, described in the protologue of *D. exilis* and mentioned repeatedly since—Macbride called them "abnormal"—, are of a type commonly observed in many daleas, especially where some of the lowest flowers are abortive. Such bracts, variously intermediate in form and texture between the upper (interfloral) bracts and the uppermost stipules, are found on a modern collection of *D. exilis* from Junín (*Soukup 1890*, US). I have not dissected a flower of holotypic *D. exilis* and cannot therefore be entirely sure of exact measurements; but the calyx, examined dry, seems altogether too small for genuine *D. boliviana* and the keel-blades (± 4 mm long) are likewise below the normal range for that species. It is perhaps not irrelevant that the most southeasterly point reached by Ruiz and Pavón in the Peruvian Andes was the town of Concepción in southern Junín, a point in the Montaro valley about 25 km upstream from Huancayo, where *D. exilis* has been collected several times in recent years. Typical *D. boliviana* is first encountered well to the southeast, in Ayacucho, and could not, so far as we now know, have been encountered by Pavón (cf. Steele, 1964, map in Appendix).

93. DALEA HUMIFUSA Bentham
(Plate XC)

Dwarf, humifuse and matted or diffusely trailing herbs developing in age a freely forking, irregularly radicant caudex, the year's growth 2–20 cm long, the young stems, foliage, and stipules pilosulous with ascending or subappressed hairs up to 0.3–0.7 mm long, the leaves when small silvery when larger greenish-cinereous, the leaflets commonly pubescent both sides, sometimes medially glabrescent or glabrous above, brown-punctate beneath; *leaf-spurs* up to 1 mm long; *stipules* narrowly ovate to lance-subulate, 1–2.2 mm long, green, brown, or livid, becoming papery; *intrapetiolular glands* spiculiform, often concealed by hairs; *post-petiolular glands* small, obtuse, little prominent; *leaves* mostly subsessile, the main cauline ones (5) 7–16 mm long, with narrowly margined rachis and 2–5 pairs of oblanceolate or linear-oblanceolate, subacute, obtuse and apiculate, or obtuse, loosely or tightly folded, dorsally keeled leaflets (2) 2.5–5 (6) mm long; *peduncles*, except the first of each main axis, terminal to leafy branchlets, commonly 0–2 cm, sometimes 1–5 cm long; *spikes* moderately dense, bluntly ovoid or subglobose becoming ovoid or cylindroid, without petals 6–7 mm diam, the pilosulous axis finally (3) 5–25 mm, sometimes 20–35 (40) mm long; *bracts* persistent, (2) 2.5–4.2 mm long, the body broadly ovate or obovate, firm almost throughout or chiefly along keel and distally, narrowly scarious-margined, (1.8) 2–3.2 mm long, dorsally gland-verruculose and pilosulous at least beyond middle, at apex truncately or cuneately contracted into a subulate tail (0.2) 0.4–1 mm long; *calyx* 2.6–3.7 mm long, pilosulous either from base upward or only about the teeth with fine ascending hairs up to 0.4–0.9 (1) mm long, the ovoid-campanulate tube 1.9–2.4 mm, slightly recessed behind banner, the filiform ribs scarcely prominent, the membranous intervals charged with 4–10 small 1-seriate (or in adaxial intervals scattered) glands, the triangular-apiculate, often minutely gland-spurred, distally green or livid teeth scarcely unequal, the dorsal one 0.6–1.3 mm long (0.7–1.7 mm shorter than tube); *petals* commonly bicolored (rarely all white), the banner white, sometimes with blue corners, gland-tipped and -sprinkled, rubescent, the epistemonous ones blue, rarely purple or lilac, perched below middle of androecium (1.2–2 mm above hypanthium), at least the keel gland-tipped; *banner* 3.5–5.1 mm long, the claw (1.2) 1.5–2.8 mm, the broadly ovate-cordate obtuse hooded blade 2.1–3.1 mm long, 2.2–3.2 mm wide, plane at junction with the claw; *wings* 2.5–4 mm long, the claw 1–1.5 mm, the ovate or oblong, often scarcely auriculate blade 1.6–2.7 mm long, 0.9–1.5 mm wide; *keel* 3.3–4.8 mm long, the claws 1.1–1.8 mm, the ovate-elliptic blades (2.1) 2.3–3.1 mm long, 1.3–2 mm wide; *androecium* 10-merous, 4.2–5.5 (5.8) mm long, the longer filaments free for 1–1.6 (2) mm, the connective gland-tipped, the pale blue anthers 0.3–0.5 mm long; *pod* obliquely obovoid, 2.1–2.4 mm long, the style-base latero-terminal, the prow slightly thickened, the valves hyaline in lower half, thence thinly papery, hirsutulous, gland-sprinkled; seed brown, sometimes purple-dotted, 1.5–1.6 mm long. — Collections: 30 (o).

Pumice plains and piedmont slopes of the great volcanoes of the Ecuadorean Andes, mostly 2400–2850 m, descending along river-banks or on outwash gravels to 1680 m (possibly lower), from e. Imbabura s. through the central valleys of Pichincha, Cotopaxi, and Tungurahua to the n. slope of Mt. Chimborazo (lat. 0° 30 N–1° 45 S). — Flowering almost throughout the year. — *Representative*: PICHINCHA: *Jameson 20* (NY), *823* (OXF, US); *Asplund 6679* (NY, US); *Wiggins 10,567* (NY). COTOPAXI: *F. C. Lehmann 4789* (F, US). TUNGURAHUA: *A. S. Hitchcock 21,735* (NY, US); *G. W. Prescott 371* (NY). CHIMBORAZO: *Spruce 5840* (F, K, NY, OXF); *Rimbach 64, 87* (F, NY, US); *Asplund 5944* (F, US).

Dalea humifusa (prostrate) Benth., Pl. Hartw. 170. 1845. — "In planitie Rumibamba prope Quito." — Holotypus, *Hartweg 954*, K (herb. Benth.)! isotypi, F (fragm.), OXF, US, isotypus formerly at B survives as *Field Neg. 2034* (F, NY)! — *Parosela humifusa* (Benth.) Macbr., Contrib. Gray Herb., New Ser. **65**: 23. 1922.

Parosela humifusa var. *anatona* (stretched upward, taller) Macbr., Field Mus., Bot. **4**: 105. 1927. — "ECUADOR: near Riobamba, 1922, *Mille 60*..." — Holotypus, collected by Fr. A. Mille, S. J., US! clastotypus (fragm.), F! — *Dalea humifusa* var. *anatona* (Macbr.) Macbr., Candollea 7: 223. 1937.

The only prostrate dalea known from the highlands of Ecuador, notable for the small size of leaf and flower. The typical form, collected by many visitors to the Equatorial Monument near Quito and elsewhere on the pumice plains of the central valley, is a truly humifuse, suffruticulose, closely matted plant with small crowded leaves, each composed of 2–4 pairs of leaflets silvery on both sides. The spike is ordinarily short and shortly pedunculate, therefore hardly emerges from the foliage, the calyx is ordinarily pilosulous from base upward, and the epistemonous petals are usually vivid blue. Color variants, from paler blue through shades of purple to pure white, are known (cf. *Paredes 2*, *2' 2''*, NY), and forms with greener, less pubescent leaves. In the foothills of Mt. Chimborazo near Riobamba a form with calyx glabrescent or even glabrous up to the always pubescent teeth is associated with the typical form; the leaflets here are green above, often obtuse. Two variants collected in quantity by Spruce have been widely distributed under unpublished varietal ("*microstachya*") or specific ("*radicata*") names, and one of them was described by Macbride as var. *anatona*, this with somewhat longer, more obviously suffruticulose caudex and longer spike and peduncle, perhaps the product of a sheltered habitat. In the Department of Imbabura, at its northern limit, *D. humifusa* descends on river gravels and outwash plains of Río Chota as low as 1640 m (*André 3550*, F, K) and loses its closely matted habit although retaining its cinereous vesture. The species appears to be plastic in habit of growth, but stable in size and form of flower.

94. DALEA CHRYSOPHYLLA Barneby
(Plate LXXXIV)

Suffruticose, the slender, sparsely branching, remotely gland-verruculose stems apparently ascending, up to 3–4 dm tall, except for old wood densely permanently pilose-tomentulose throughout with fine ascending and spreading ± tangled hairs up to ± 0.7 mm long, the herbage probably silvery when fresh, golden when dry, the leaflets equally pubescent both sides, punctate under the vesture beneath; *leaf-spurs* 0.4–0.7 mm long; *stipules* linear-setiform but soft, 3–5 mm long; *intra-* and *post-petiolular glands* very small, concealed by vesture; *leaves* shortly petioled, the main cauline ones 2–3 cm long, with very narrowly margined rachis and 4–5 pairs of subsessile, oblong-elliptic or -obovate, apically penicillate and gland-mucronate, shallowly concave, dorsally keeled, thick-textured leaflets 4–7 mm long, the terminal one usually stalked; *peduncles*, except the first of each primary axis, terminal to lateral branchlets, 2–6 cm long; *spikes* moderately dense, the flowers ± 3-ranked after anthesis, ovoid becoming cylindroid, without petals 8 mm diam, the densely villosulous axis becoming 1.5–5 cm long; *bracts* persistent, 4–4.5 mm long, densely pilosulous dorsally, the navicular body 2–2.7 mm long, in profile 0.9–1.1 mm wide, contracted into a subulate tail ± 1.5–2 mm long; *calyx* 4.4–4.5 mm long, pilosulous from base upward, the tube (measured to dorsal sinus) 2.8–3 mm long, recessed behind banner, the orifice oblique, the livid ribs filiform, the membranous flat intervals charged with 5–9 tiny glands arranged in 2–3 rows, the teeth deltate-apiculate, the dorsal one longest, 1.5–1.8 mm long (1.2–1.5 mm shorter than tube), the ventral pair shorter and

broader; *petals* bicolored, the whitish, gland-sprinkled and -tipped banner early rubescent, the epistemonous ones bright blue, perched low on androecium (1.4–2 mm above hypanthium), the keel gland-tipped; *banner* 4.6–4.8 mm long, the claw 2 mm, the broadly ovate-cordate hooded blade 2.9 mm long, 3.6 mm wide; *wings* 4.1–5 mm long, the claw 1.1–1.4 mm, the obliquely ovate blade 3.1–4 mm long, 1.6–2 mm wide; *keel* 5.2–5.6 mm long, the claws 1.6–1.8 mm, the blades 3.7–4 mm long, 2.2–2.6 mm wide; *androecium* 10-merous, 5.5–6 mm long, the longer filaments free for 1.6–2 mm, purple distally, the connective gland-tipped, the anthers 0.3–0.45 mm long; *pod* 2.4 mm long, in profile half-obovate, the style-base terminal, the valves hyaline and glabrate in lower half, thence very thinly papery, gland-sprinkled, pilosulous; *seed* ± 1.7 mm long. — Collections: 2 (o).

Habitat little known, sometimes in old fields, near 2100 m, known only from the w. slope of the Andes in Azuay, Ecuador. — Flowering September to November. — *Material*: ECUADOR. _____ : *W. Lobb, s.n.* (K, herb. Hook., recd. 1867). AZUAY: typus.

Dalea chrysophylla (golden-leaved, of the dense pubescence) Barneby, sp. nov., inter congeneres andinas parvifloras pube omnium partium piloso-tomentosa valde densa in sicco aurata praestans, a sympatrica *D. ayavacensi* var. *killipii* subsimiliter tomentosa statura minori ac calyce brevidentato ab ipso basi pilosulo, utroque tubi intervallo glandulis numerosis parvulis sparsis nec in 2 (3) lineares confluentibus obsito facilius separata. — Suffrutices 3–4 dm altae undique densissime piloso-tomentosae, pube exsiccata aurea; *folia* majora 2–3 cm longa, foliolis 4–5-jugis oblongo-obovatis 4–7 mm longis; *spicae* densiusculae anguste ovoideae demum cylindricae, petalis ablatis 8 mm diam, 1.5–5 cm longae; *bracteae* persistentes 4–4.5 mm longae medium versus in caudam brevem contractae; *calycis* tubus ± 2.9 mm longus ad orem obliquus, dentes deltato-apiculati 1.5–1.8 mm longi; *petala* bicoloria, vexilli ± 4.7 mm longi lamina albida mox rubescenti, episteMonea coerulea carinae laminis 3.7–4 mm tantum longis. — ECUADOR. AZUAY: old field, 90 mi s. of Cuenca, 7000 ft, oct 2, 1944, *Ira L. Wiggins 10,838*. — Holotypus, NY; isotypus, US.

This suggests a densely pannose-tomentulose version of *D. humifusa* or *D. exilis*. The only sympatric dalea similarly pubescent is *D. killipii* var. *killipii*, very like it in the individual leaf but at the same time very different in its greater stature, long calyx-teeth, and externally glabrous calyx-tube charged in each interval with a single linear gland. The type-collection of *D. chrysophylla* was distributed as *D. sericophylla* Ulbr., to which it would key following Macbride's revision of the Andean species, but differs in its short-tailed bracts and smaller flowers. The poorly known *D. sericophylla* has been collected only in northern Peru (Cajamarca) and is interpreted herein as a variety of the middle-Peruvian *D. weberbaueri*. A third densely pubescent dalea was collected long ago in the province of Chachapoyas, but in specimens (*Mathews in 1835*, OXF, K) inadequate for thorough study. It appears to differ from *D. chrysophylla* in its substantially larger corolla, but the value of these differences will obviously need reevaluation as more material becomes available.

95. DALEA TAPACARIENSIS Harms
(Plate LXXVI)

Herbaceous from a slender, forking, yellow root, perhaps annual, certainly of short duration, appearing glabrous to the spike but the young stems distally and the stipule-margins puberulent with weak scattered loose hairs up to 0.2–0.3 mm long, the sparse-

ly leafy, diffuse and incurved, irregularly few-branched stems up to 2.5 dm long, stramineous and minutely gland-verrucose, the foliage glabrous, greenish-glaucescent, the thick-textured leaflets smooth above, dotted beneath; *leaf-spurs* 0.7–1.2 mm long; *stipules* linear-lanceolate, membranous, 2.5–3.5 mm long; *intrapetiolular glands* minute, impressed; *post-petiolular glands* small, prominent but blunt; *leaves* 1.5–2.5 cm long, subsessile, with green-margined, ventrally grooved rachis and 4–6 rather distant pairs of broadly oblong-obovate to broadly oblanceolate, obtuse but gland-mucronate, loosely folded leaflets 4–6 mm long, the terminal one either short-stalked or sessile; *peduncles* (of the young plant seen) leaf-opposed, 1–3 cm long; *spikes* at early anthesis ovoid-conic, without petals ± 9 mm diam, 10 mm long, probably remaining dense and ovoid; *bracts* apparently persistent, ± 4 mm long, the navicular body ± 2.5 mm long, in profile 1.5 mm wide, clasping the calyx, membranous-margined, dorsally livid and gland-sprinkled, glabrous, contracted into a subulate livid ciliolate keel ± 1.5 mm long; *calyx* 3.9 mm long, pilosulous with spreading hairs ± 0.4–0.5 mm long, the tube (measured to dorsal sinus) 2.6 mm long, strongly oblique at orifice but not recessed behind banner, the ribs filiform, livid, the intervals membranous, charged with 1 row of 2–3 tiny yellowish glands, the triangular-ovate short-acuminate teeth unequal, the dorsal one 1.3 mm long, the rest shorter and slightly broader, all shortly plumose; *petals* bicolored, the banner and keel whitish, the distal half of the wings dark vivid blue, the epistemonous ones perched below middle of androecium (1.1–1.9 mm above hypanthium), the keel minutely gland-tipped; *banner* 3.9 mm long, the claw 1.7 mm, the ovate-cordate blade 2.7 mm long, almost as wide, recessed into a shallow cornet at top of claw, the eye charged with a few minute glands; *wings* 3.2 mm long, the claw 0.9 mm, the oblong-oblanceolate blade 2.4 mm long, 1 mm wide; *keel* 3.8 mm long, the claws 1 mm, the broadly obovate blades 2.8 mm long, 1.8 mm wide; *androecium* 10-merous, 5.5 mm long, the longer filaments free for 1.3 mm; *pod* unknown. — Collection: 1 (typus).

Habitat unknown, collected once only, at ± 3000 m, near e. edge of the Andean Plateau in Cochabamba, Bolivia.

Dalea tapacariensis (of type-locality) Harms ex O. Kze., Rev. Gen. **3**[3]: 59. 1898. — "Bolivia: 3000 m Rio Tapacari." — Holotypus, formerly at B, survives as *Field Neg. 736* (F, NY, US)! isotypus (probably matching half of same plant), NY (herb. Kuntze.)!

In general aspect the one known example of *D. tapacariensis* suggests a seedling *D. boliviana* just coming into flower. The calyx is only slightly smaller than the smallest known in *D. boliviana*, but the petals are much smaller, the keel-blade only ± 2.8 (not 4.3̇ +) mm long. Furthermore, only the wing-petals are tipped with vivid blue, the banner and keel both opening whitish, a color-pattern otherwise unknown in Andean daleas. The species cannot be accepted without reservation until its characters can be described from mature material. If I am right in thinking that the specimens in the Berlin and Kuntze herbaria are halves of one and the same plant, the concept derives from just one individual, collected, moreover, from within the known range of *D. boliviana*.

Note: A strongly characterized but undescribed species of *Dalea* ser. *Coeruleae* is known from incomplete material from "Northern Peru, coll. *Col. R. J. Stordy*, recd. jan 1921." (K). It is remarkable for its loose, narrow, many-flowered spike (without petals ± 9 mm diam, the axis 3–6 cm long) of small, short-toothed calyces densely villosulous with fine vertical hairs up to 0.3–0.4 mm long. The calyx-tube is 2.8–3 mm long, the intervals charged with one linear blister-gland 1–1.8 mm long situated below middle of the panel and surmounted by 1–2 small ones situated above middle. The epistemonous petals appear to have been violet, the keel-blades about 5 mm long. The early deciduous interfloral

bracts suggest *D. onobrychis*, but the pubescence and intercostal glands of the calyx are very different.

IVC (x). Series Moquehuanae Barneby

Filiform annual herbs; *leaflets* 3–5 pairs; *calyx* short-toothed; *petals* very small and pale, the epistemonous ones perched near middle of androecium, the detached keel substantially shorter than banner; *androecium* 7-merous, only 5 stamens fertile. —Sp. 1, of the Pacific slope in s. Peru.

Dalea subgen. **Parosela** sect. **Parosela** ser. **Moquehuanae** Barneby, ser. nov., flore parvulo degenerato, petalis epistemoneis minimis ad medium androecium insertis, carina (delapsa) vexillo breviori, androecioque 7-mero praestantes. — Sp. unica: **D. moquehuana** Macbr.

96. Dalea moquehuana Macbride
(Plate CXXX)

Slender annuals, 0.8–2 dm tall, the solitary erect simple 1–3-cephalous stem glabrous and purplish toward base, then straminous and thinly pilosulous with fine weak spreading hairs up to 0.4–1 mm long, the foliage sparse and early deciduous, the subpersistent leaf-stalks pilosulous, the membranous, flat or loosely folded leaflets green and glabrous above, either glabrous or thinly pilosulous beneath, or ciliolate, minutely gland-sprinkled dorsally; *leaf-spurs* 0.4–0.7 mm long; *stipules* linear-caudate, stramineous, thinly pilosulous 1.5–5 mm long; *intrapetiolular glands* 2, small; *postpetiolular glands* prominent, small, blunt; *leaves* 1.5–3.5 cm long, with narrowly margined rachis and (2) 3–5 pairs of oblanceolate to oblong-obovate, deeply retuse or obtuse leaflets 4–8.5 (9) mm long, the terminal one stalked; *peduncle* 3–30 mm long; *spike* moderately dense, ovoid becoming oblong, ± 0.7 mm diam, the pilosulous axis (4) 8–20 mm long; *bracts* persistent, 3–4 mm long, the oblong-obovate navicular body loosely clasping base of calyx, 2–2.4 mm long, in profile 0.6–0.9 mm wide, broadly hyaline-margined, along the back above middle herbaceous, livid, sparsely gland-pustulate and pilosulous, abruptly contracted into a subulate tail 1.4–1.7 mm long; *calyx* 3.3–4.1 mm long, pilosulous with ascending spiral hairs up to 0.6–0.9 mm long, the tube 1.8–2.1 mm long, somewhat recessed dorsally, the ribs slender but prominulous, the flat hyaline intervals charged with 1 row of 3 (4) small golden glands, the triangular-aristate teeth unequal, the dorsal one 1.4–2 mm long, the lateral and ventral pairs successively a little shorter, all entire and plumulose to apex; *petals* pale purplish or whitish, glabrous and glandless, the wings very small or perhaps sometimes lacking, the keel perched near or above middle of androecium, ± 2 mm above hypanthium; *banner* 3.4–3.5 mm long, the filiform claw 1.9–2.3 mm, the deltate-cordate, minutely emarginate blade open at base, 1.2–1.6 mm long; *wings* ± 1.8 mm long, the claw 0.9 mm, the obliquely oblanceolate blade 0.9 mm long, 0.4 mm wide; *keel* 2.4–2.6 mm long, the claws 0.7–1.2 mm, the obliquely ovate blades 1.5–1.8 mm long, 0.9 mm wide; *androecium* 7-androus, 3.4 mm long, the central stamen and two on each side fertile, two interposed barren and shorter, the longer filaments free for 0.7 mm, the connective gland-tipped, the anthers 0.2 mm long; *pod* 2–2.5 mm long, in profile almost isotriangular, each side slightly convex, the style-base at corner, the prow filiform, livid, the valves in upper ⅓ thinly papery, eglandular, barbu-

late with hairs up to 0.5–0.8 mm long, in lower ⅔ hyaline, glabrous; *seed* 1.5–1.7 mm long. — Collections: 2 (o).

Stony places, 1900–2000 m, known only from two localities on the Pacific slope of the Peruvian Andes in s. Ayacucho and Moquegua. — Ephemerophyte, flowering after rains. — *Material*: AYACUCHO. Lucanas: between Nazca and Puquio, *Ferreyra 5486* (US).

Dalea moquehuana (of Depto Moquegua) Macbr., Field Mus., Bot **13**[3]: 370. 1943. — "Moquehua: Between Moquehua and Torata, rainy-green formation, 2000 meters, *Weberbauer 7433*..." — Holotypus, collected March 21, 1925, F! = *NY Neg. 8602*; isotypi, GH, WIS!

A preeminently singular little dalea, the only monocarpic one known to occur on the west slope of the Peruvian Andes and, with the exception of the Bolivian *D. tapacariensis*, the only autochthonous annual *Dalea* in South America. A simple, erect, subfiliform but wiry stem ending in one to three spikes of plumose calyces characterizes the very few specimens examined, but more vigorous individuals, branched from the base or distally, must be expected. The species seems beautifully adapted to the irregular and precarious rainfalls of its desert home, prepared to shed at first the leaflets and eventually the leaf-stalks of all cauline leaves before the pods reach full maturity. The degeneration of the extremely small, almost colorless corolla, involving the loss sometimes of wing-petals and (so far as known) always of some stamens, is of great interest because it runs parallel with that observed in several North American species of subgen. *Dalea*. The process has not gone so far, however, to obscure the relationship of *D. moquehuana* to the herbaceous but perennial *D. exilis* and kindred small-flowered species of the Amazon watershed, for the calyx and petals, although diminished in size, have remained in form little altered.

IVC (ix). Series GALBINAE Barneby

Shrubs; *leaves* small, 7–14 mm long, with 2–3 pairs of small, thick-textured leaflets; *calyx-tube* 20-ribbed, short-toothed; *petals* all pale yellow (not rubescent). — Sp. 1, of centr. Peru.

Dalea subgen. **Parosela** sect. **Parosela** ser. **Galbinae** Barneby, ser. nov., a ser. *Coeruleis* imprimis tubo calycino 20-costato, ulterius petalis omnibus sulfureis foliolisque paucis (2–3-jugis) parvulis carnosulis absimiles. — Sp. unica: **D. galbina** (Macbr.) Macbr.

97. DALEA GALBINA (Macbride) Macbride
(Plate LXXXIII)

Awkwardly open-branching, sparsely leafy shrubs up to 1–1.5 mm tall, appearing glabrous to the silky-barbate spikes but the young twigs, the leaf-rachis, and the stipules internally pilosulous with fine ascending hairs up to 0.4–0.5 mm long, the low-tuberculate stems at first castaneous but the old bark becoming gray and furrowed, the foliage green, the small, thick-textured leaflets smooth above, densely punctate beneath; *leaf-spurs* 0.5–1 mm long; *stipules* triangular-subulate castaneous, dorsally glabrous; *intrapetiolular glands* 2 immersed; *post-petiolular glands* small but prominent; *leaves* shortly petioled, the main cauline ones 7–14 mm long, with thick-margined punctate rachis and 2–3 pairs of narrowly obovate but tightly folded (thus apparently oblanceolate) emarginate, mostly backward-arched leaflets 2–3 mm long, the terminal leaflet sessile, the leaves of numerous knoblike spurs axillary to drought-

deciduous primary ones similar but smaller with only 1–2 pairs of tiny leaflets; *peduncles* terminal to leafy branchlets of the year, 1–1.5 cm long; *spikes* moderately dense, narrowly ovoid-acuminate becoming cylindroid, without petals 10–11 mm diam, the densely pilosulous axis 2–5 cm long; *bracts* deciduous, 2.5–3.5 mm long, the broadly oblong-elliptic, navicular body 2–3 mm long, in profile 1.1–1.3 mm wide, narrowly membranous-margined, heavily gland-tuberculate and (especially at base and distally) thinly pilosulous, glabrous within, abruptly contracted into a subulate cusp up to 0.5–0.7 mm long; *calyx* 4.4–4.6 mm long, densely pilose with straight spreading-ascending hairs up to 1.2–1.5 mm long, the tube 2.4–2.5 mm long, recessed behind banner and the orifice oblique, with 10 primary and also 10 intercalary ribs, these slender but prominulous, castaneous or livid, the 20 intervals charged each with 1 row of 3–5 orange glands, the triangular, gland-spurred teeth somewhat unequal, the dorsal one 2–2.1 mm long (± 0.4 mm shorter than tube); *petals* pale greenish-yellow, not fading brown, the banner heavily gland-sprinkled in the greenish eye and like the keel gland-tipped, the epistemonous ones perched low on androecium (1.4–1.9 mm above hypanthium); *banner* ± 6.7 mm long, the claw 3.2 mm, the suborbicular-flabellate blade 3.7–4 mm long, 4 mm wide, the basal lobes folded inward and adherent to form lateral pockets, the cornet at base shallow; *wings* 6 mm long, the claw 2 mm, the lance-ovate blade 4.3 mm long, 1.9 mm wide; *keel* 7.7 mm long, the claw 2.4 mm, the elliptic blades 5.7 mm long, 2.4 mm wide; *androecium* 10-merous, 7.5 mm long, the longest filaments free for 2.7–3 mm, the connective gland-tipped, the yellowish anthers 0.7 mm long; *pod* not known. — Collection: 1 (typus).

Rocky outcrops, ± 2330 m (7000 ft), known only from the type-locality on upper Río Huallaga, e. slope of Peruvian Andes in lat. ± 10° S. — Flowering late April and May.

Dalea galbina (Macbr.) Macbr., Candollea **7**: 222. 1937, based on *Parosela galbina* (greenish-yellow) Macbr., Field Mus., Bot. **4**: 104. 1927. — "PERU: southwestern rock-outcrops, Huanuco, April 26, 1923, *Macbride 3500...*" — Holotypus, F! = *NY Neg. 8603*; isotypus, US!

A singular dalea, the only member of the genus with 20-ribbed calyx, and the only Peruvian species, other than *D. cylindrica*, with yellow petals. The yellow-flowered forms of *D. cylindrica*, all confined to the Pacific slope of the Andes, are easily distinguished by their more ample, thin-textured leaflets and persistent interfloral bracts.

IVC (xii). Series Cyaneae (Rydberg) Barneby

Weakly suffrutescent; *leaflets* 4–8 pairs; *spikes* conelike; *bracts* persistent, dimorphic; *calyx-tube* deeply recessed behind banner, longer than the broad teeth; *banner* as long or slightly longer than detached keel, white except for colored basal lobes, the epistemonous petals vivid blue or purple. — Sp. 1, of Sierra Madre Occidental, Mexico.

Dalea subgen. **Parosela** sect. **Parosela** ser. **Cyaneae** (Rydberg) Barneby, stat. nov., based on *Parosela* subgen. *Euparosela* XXI. *Cyaneae* Rydb., N. Amer. Fl. **24**: 86. 1920. — Sp. unica: *P. cyanea* (Greene) Rose = **Dalea cyanea** Greene.

Parosela subgen. *Euparosela* XXIV. *Pilosissimae* Rydb., N. Amer. Fl. **24**: 1920. — Sp. unica: *P. pilosissima* Rydb. = (syn. tax.) **Dalea cyanea** Greene.

A species of unknown kinship, without any close Mexican relative but suggestively resembling some Andean *Coeruleae* in the form and coloring of the petals. It differs from all *Coeruleae* in its strongly asymmetric calyx-tube.

98. DALEA CYANEA Greene
(Plate XCI)

Diffuse, polypodial, herbaceous or weakly suffruticose perennial herbs, the radiating, stramineous, livid, or castaneous stems branching at and beyond the middle, 2–6 dm long, charged distally with at least a few and often many small protuberant orange glands, variable in pubescence but never wholly glabrous below the spikes, the foliage often glabrous or nearly so, but the main cauline leaves sometimes green and contrasting with silvery-pilose leafy spurs developed low on the plant at late anthesis, rarely pilosulous throughout with widely spreading spiral hairs up to 0.4–0.8 mm long, always residually pilosulous on the peduncles, the rather thick-textured leaflets conspicuously punctate beneath and often more faintly so above; *leaf-spurs* 0.6–1.5 mm long; *stipules* lanceolate or lance-caudate, papery or early becoming so, often castaneous, (2) 3–6 mm long, commonly glabrous or nearly so dorsally; *intrapetiolular glands* small, hemispherical; *post-petiolular glands* prominent, orange or fuscous, obtuse or mammiform; *main cauline leaves* 1–4.5 cm long, shortly petioled or subsessile, with narrowly margined rachis and 4–8 pairs of oblong-oblanceolate, -elliptic, or -obovate, obtuse to subemarginate but often bluntly gland-mucronulate, boat-shaped, loosely folded, or marginally involute leaflets (1.5) 2.5–9.5 mm long; *peduncles* terminal to all branchlets, 1–9 (12) cm long; *spikes* very dense, conelike, ovoid or subglobose becoming ovoid-oblong, without petals 8–14 mm diam, the pilosulous axis becoming 0.7–2 cm long; *bracts* persistent, dimorphic, the outermost ovate- to broadly lance-acuminate, glabrous except at very base, thick-textured throughout, the inner ones oblanceolate, pallid and thin-textured at the narrow base, herbaceous, livid-castaneous, gland-charged and dorsally pilosulous distally, the tip often glabrate, glabrous within; *calyx* (3.7) 4–5.7 mm long, pilosulous throughout with fine, spreading hairs up to 0.3–0.7 mm long, the tube (sometimes glabrescent at base) rather narrowly campanulate, recessed ± half its length behind the banner, 2.5–3.6 mm long measured to a dorsal sinus, the ribs slender, pale, becoming prominent only in fruit, the membranous, pallid intervals charged with (1) 2–5 (7) small, orange or colorless glands, the triangular or (when short) deltate, short-acuminate, gland-spurred, livid teeth a little unequal, the dorsal one 1.1–2.7 mm long (0.5–2.5 mm shorter than the tube), the ventral pair a little shorter and broader; *petals* opening bicolored, the banner sometimes colored at base and tip of blade but largely white, rubescent in age, the inner ones blue or purple, raised only 1–2.4 mm above the hypanthium rim, usually all glandless but the banner sometimes gland-tipped; *banner* 6.5–10 mm long, the claw 3.5–4.1 mm, the ovate-cordate or suborbicular, emarginate, gently recurved blade 3.6–6 mm long, 3.2–4.8 mm wide, closed at base into a cornet-like well; *wings* 5.6–6.6 mm long, the claw 1.7–2.2 mm, the oblong-oblanceolate or lance-oblong blade 4–5.8 mm long, 1.5–2.3 mm wide; *keel* 7.4–10.5 mm long, the claws (2.6) 3–4.2 mm, the broadly oblanceolate to oblong-obovate blades 4.8–6.5 mm long, 2.4–3.3 mm wide; *androecium* 7.2–9.2 mm long, the longest filament free for ± 2.4–3 mm, the anthers 0.55–0.7 mm long; *pod* obliquely obovoid, 2.3–2.9 mm long, the style terminal but excentric, the valves membranous, almost transparent, thinly pilosulous distally, the keels filiform, the dorsal one dehiscent in age, the seed 1.6–1.7 mm long.

The striking diagnostic features of *D. cyanea* are the relatively few leaflets, the subglobose, conelike spikes, the dimorphic bracts, the deeply recessed adaxial sinus of the calyx, and the proportionately very large banner which nearly or quite equals in length the detached keel. In Rydberg's monograph (1920, pp. 74, 86, 91) forms of the species

are introduced in three places, under the names *Parosela cyanea, P. pilosissima*, and *P. fissa*, the two first figuring as types of monotypic sections, the third, misinterpreted as annual, associated with the entirely different *D. polygonoides*. Field experience in the Sierra Madre west of Ciudad Durango has shown the *D. cyanea* and *P. pilosissima* represent respectively less and more densely pubescent phases of one entity. The status of *P. fissa*, which is still known only from the two collections already available to Rydberg fifty years ago, remains controversial. It seems to be distinguished only by greater development of the bracts and stipules and by pink-purple, not vivid blue petals.

Key to the Varieties of *Dalea cyanea*

1. Outer bracts ± 3–5 mm long, up to 2 mm wide; *inner bracts* shorter than the calyx; *wings and keel* vivid blue; e. slope of Sierra Madre in s.-w. Durango. 98a. var. *cyanea*.
1. Outer bracts 4–7 mm long, up to 3 mm wide; *inner bracts* a little longer than the calyx; *wings and keel* rose-purple; Sierra de Nayarit, n. Nayarit. 98b. var. *fissa*.

98a. Dalea cyanea Greene var. cyanea

(Plate XCI)

Very variable in pubescence, the foliage green and glabrous except for a few scattered hairs on the leaf-rachis, or softly and finely pilose except for glabrate upper face of the leaflets; $2n = 7_{II}$ (Mosquin); otherwise as given in the key. — Collections: 10 (ii).

Open sunny slopes and canyon benches, in oak-pine forest, 1950–2500 m (± 6800–8300 ft), locally common on the east slope of the Sierra Madre due w. and s.-w. of Ciudad Durango, Durango. — Flowering July to October. — *Material*: Durango. Empalme Purísima, *Pennell 18,253* (NY). El Salto road, at points 26–51 mi w. of Durango, *Waterfall 13,729* (OKLA), *16,180* (NY, OKLA, UC), *Maysilles 8083* (US), *Correll & Johnston 20,121* (RENNER), *Ripley & Barneby 13,488* (CAS, NY, US), *14,002* (CAS, MEXU, MICH, NY, US), *Mosquin et al. 6878* (NY).

Dalea cyanea (blue) Greene, Pittonia **1**: 153. 1888. — "...by Mr. A. Forrer, in the autumn of 1881, on the higher Sierra Madre back of the city of Durango, in Mexico... about 8100 feet." — Holotypus, ND (?), not seen; isotypi, F, UC, US! — *Parosela cyanea* (Greene) Rose, Contrib. U. S. Nat. Herb. **10**: 105. 1906.

Parosela pilosissima (densely hairy) Rydb., N. Amer. Fl. **24**: 91. 1920. — "Type collected at the city of Durango and vicinity, 1896, *Palmer 808*..." — Holotypus, GH! isotypi, F, UC, US! — *Dalea pilosissima* (Rydb.) Bullock, Kew Bull. **1939**: 197. 1939.

The mature plant of *D. cyanea* forms a cartwheel, up to 7 dm in diameter, of radiating reddish stems that branch paniculately near or above the middle, each branchlet bearing aloft on an incurved peduncle a tight, knoblike head of particolored flowers. In the newly opened flower the banner is white, or white tipped with blue, but the white area soon turns reddish; the inner petals are an intense, sparkling blue. Commonly the stems are thinly pilosulous and the main cauline leaves green and glabrous, but the caudex of such plants gives rise, late in the year, to leafy spurs densely pilosulous throughout with fine, shining hairs. The typus of *P. pilosissima* is an example, comparatively rare in the species as now known, in which the stems and primary foliage are pilose like the autumnal spurs. Rydberg

described *P. pilosissima* as a "low, intricately branched shrub", but there is nothing in the specimens to suggest such a habit of growth. The oldest plants of *D. cyanea* develop a somewhat suffrutescent caudex, but never become truly shrubby.

The range of *D. cyanea* as known from precise data lies athwart the Durango-El Salto highway across the Sierra Madre and has a circumference, measured east to west, of about thirty km. Its northern and southern limits along the Sierra are still to be ascertained. Gentry (1942, p. 137) tentatively identified as *D. cyanea* specimens collected in Chihuahua, at San José de Pinal and Memelichi, but these have turned out to represent a blue-flowered state of *D. lumholtzii*.

98b. Dalea cyanea Greene var. fissa (Rydberg) Barneby
(Plate XCI)

Appearing glabrous to a glance, but the stems at base, and the leafstalk and lower face of the leaflets of at least some early leaves, thinly pilosulous with weak, spreading hairs, the peduncles pilosulous under the spikes; *tail* of the inner bracts recurved, the young spike teasel-like; otherwise as given in the key. — Collections: 2 (o).

Habitat not recorded, but to be expected in open pine-forest at ± 2000 m, known only from the north end of Sierra de Nayarit, near Sta. Teresa, Nayarit. — Flowering August–September. — *Material*: Nayarit. Sta. Teresa, *Rose 2192* (NY, US).

Dalea cyanea Greene var. **fissa** (Rydb.) Barneby, stat. nov., based on *Parosela fissa* (cleft, of the deep ventral sinus of the calyx) Rydb., N. Amer. Fl. **24**: 74. 1920. — "Type collected near Santa Teresa, Tepic, August 11, 1897, *Rose 2181*..." — Holotypus, collected by Joseph Nelson Rose, US! isotypi, GH, NY!

While Sierra de Nayarit is generally considered an organic part of the great Sierra Madre range, it constitutes by itself a distinct massif, detached from the highlands west of Durango by the broad, deeply excavated valley of Río Mezquital. Thus although the type-locality of var. *fissa* lies less than 200 km south of the known dispersal center of var. *cyanea*, it is to some degree isolated, enough so, perhaps, to harbor an endemic race. Nevertheless the status of var. *fissa* will remain uncertain until its characters can be tested against more collections. As now known, the plant is a trifle taller than var. *cyanea* (stems 5–6 rather than 2–4 dm long), and the sparse pubescence of the lower leaves is composed of longer and weaker hairs. The vesture of the calyx is a trifle longer and denser, but I have found no more substantial differential character than the coarser bracts and stipules and the different flower-color already mentioned in the varietal key. In all plants of Rose's two collections the leaflets are reflexed from the rachis on curved petiolules, a feature stressed by Rydberg in his key to species-group *Polygonoides* (1920, p. 68). The leaflets are merely, however, caught in the so-called sleeping posture, adopted toward sundown by leaves of many subtropical daleas, as also by leaves of specimens confined for an hour or so in the darkness of a vasculum. In Plate XCI the leaflets are drawn as though revived to their natural stance as noon.

IVC (xiii). Series Mucronatae (Rydberg) Barneby

Tall virgate herbs branching distally into panicles of short, very dense spikes; *leaflets* 7–15 pairs, relatively large, some usually over 1 cm long, short-acuminate; *bracts* small, persistent, silky within; *calyx* glabrous externally, the firm, lustrous tube

longer than the internally silky teeth; *petals* small, greenish-white or ochroleucous on expansion, the banner rubescent, ± as long as the detached keel, the blades of the latter ± 3.5–4.5 mm long. — Sp. 1, of centr. Mexico, chiefly of the basin of Rio Lerma and its affluents.

Dalea subgen. **Parosela** sect. **Parosela** ser. **Mucronatae** (Rydberg) Barneby, stat. nov., based on *Parosela* subgen. *Euparosela* XXVII. *Mucronatae* Rydb., N. Amer. Fl. **24**: 94. 1920. — Sp. unica: *P. mucronata* (DC.) Rose = **Dalea mucronata** DC.

A singular monotype of unknown relationship, already recognized as such by Rydberg, *D. mucronata* resembles some *Pectinatae* in tall virgate stems and upward reduction of the foliage, but differs conspicuously in the small conelike spikes, the small firm glandless calyces, and greenish-white petals. The expanded, short-acuminate leaflets recall *D. leptostachya*, very different in its loose spike, deciduous bracts, and yellow petals. The small, externally vernicose calyx recalls that of *D. tomentosa* var. *psoraleoides*, but foliage and habit are in no sense comparable.

99. Dalea mucronata DeCandolle

(Plate XCII)

Tall, coarse herbs with (1) 2–several erect or virgately ascending, smooth or striate, reddish stems 1–1.8 m tall, becoming indurated basally late in the season but not persistent in the form of a caudex, simple and leafy to the middle or beyond, then branched and sparsely tuberculate distally, the foliage much reduced in the inflorescence which forms a loose panicle of spikes, either wholly glabrous up to the spikes or the upper leaves thinly pubescent dorsally in youth, but the stems sometimes bearing late in the dry season short, subbasal spurs bearing reduced leaves with 2–3 pairs of densely white-pilose leaflets; *leaf-spurs* very short or obscure; *stipules* narrowly lance-acuminate to linear-elliptic, firm, foliaceous, 5–14 mm long, with rigid midrib, punctate dorsally; *intrapetiolular glands* 2, prominent, like the post-petiolular glands conic or prickle-shaped; *main cauline leaves* 4–8.5 cm long, with very narrowly margined rachis and 7–13 (15) pairs of ovate- or oblong-elliptic, basally subcordate to broadly rounded, apically short-acuminate (quasi-mucronate), dorsally carinate, flat leaflets 6–15 mm long, smooth and green above, strongly multipunctate beneath, the distal rameal leaves similar but shorter, with fewer (3–7) pairs of smaller but otherwise similar leaflets; *peduncles* 0.5–10 cm long (often appearing longer due to suppression of ultimate leaves); *spikes* very dense, subglobose or ovoid becoming ovoid-oblong to short-cylindroid, without petals 8–10 mm diam, the villosulous axis 0.5–5 cm long; *bracts* persistent, ovate-acuminate or -caudate, 3–5.5 mm long, cymbiform and embracing base of calyx, the lowest glabrous dorsally, the rest pilosulous externally in the lower half, livid-glandular and ciliolate distally, all silky within; *calyx* 3.9–4.9 mm long, glabrous externally except for a crest of short, spreading hairs extending backward from the ± recessed dorsal sinus, the campanulate tube 2.5–3 mm long, thick-textured, pallid or livid-castaneous and lustrous externally, the ribs immersed, the intervals poorly differentiated in texture and eglandular, the subulate or triangular-subulate teeth up to 1.2–1.8 mm long, the dorsal one longest, the ventral pair shortest and broadest, the orifice oblique, the teeth all minutely gland-spurred; *petals* greenish-white or ochroleucous, the banner early fading dull pinkish-red, all

glandless, the inner ones perched ± 2.4–3.1 mm above the hypanthium rim, the keel-blades united by their outer margins; *banner* 4.6–5.5 mm long, the claw 2.4–2.8 mm, the cordate blade 3.1–3.5 mm long, 2.4–3.2 mm wide; *wings* 4.2–5 mm long, the claw 0.8–1.3 mm, the blade 3.5–4 mm long, 1.6–2.2 mm wide; *keel* 4.8–5.4 mm long, the claws 1.3–1.6 mm, the broadly obovate-elliptic blades 3.6–4.5 mm long, 2–2.5 mm wide; *androecium* 6–7.5 mm long, the longest filament free for ± 2.7 mm, the connective gland-tipped, the anthers 0.65–0.8 mm long; *pod* in profile obliquely deltate, 2.2–2.5 mm long, the ventral suture slightly convex, the dorsal suture and prow filiform, the valves hyaline in lower half, thence thinly papery, thinly pilosulous distally or merely ciliolate below the style; *seed* 1.6–1.8 mm long; 2n = 14 (Mosquin). — Collections: 15 (v).

Dry rocky hillsides and valley-floors, in arid grassland, ipomoea forest, and thin oak woodland, 1500–2700 m (± 5000–9000 ft), uncommon and occurring usually as scattered individuals, thinly dispersed around the foothills, in valleys of Río Lerma and its affluents from the n., from Guadalajara, Jalisco, n. to s. Zacatecas and Aguas Calientes, upstream through the Bajio and the lake-basins of n.-e. Michoacán to n.-e. Guanajuato and, perhaps disjunctly, to the Valley of Mexico. — Flowering September to November. — *Representative*: ZACATECAS: road to Huejuquilla El Alto, *McVaugh 16,907* (MICH). JALISCO: n.-w. of Huejuquilla El Alto, *Feddema 2376* (MICH); 17 mi n.-w. of Lagos de Moreno, *Ripley & Barneby 14,516* (CAS, DAO, MEXU, NY); Guadalajara, *Pringle 2353* (BR, F, M, MEXU, NY, UC, W). AGUAS CALIENTES: 10–20 mi w. of Aguas, *McVaugh & Koelz 86* (MICH). MICHOACÁN: 24 km w. of Morelia, *Ripley & Barneby 14,848* (CAS, DAO, GH, MEXU, MICH, NY, US); 7 mi e. of Quiroga, *Ripley & Barneby 13,426* (MEXU, NY); 3 mi s.-e. of Quiroga, *Breedlove 18,704* (NY). GUANAJUATO: 13 mi w. of Dolores Hidalgo, *Ripley & Barneby 13,375* (CAS, NY, US). MÉXICO (Edo): Lechería, *Pringle 8917* (K, L, M, MEXU, NY, UC, US, W). MÉXICO (D. F.): Cerro de Progreso, *Matuda 19,672* (MEXU, NY).

Dalea mucronata (mucronate, of the leaflets) DeCandolle, Prod. **2**: 246. 1825. — "...in Mexico." — Holotypus, "ex herb. Thibaud., 1815", G-DC! *Parosela mucronata* (DC.) Rose, Contrib. U. S. Nat. Herb. **10**: 104. 1906.

Dalea aristata (bristle-tipped, of the pointed leaflets) Bentham, Pl. Hartweg. 11. 1839. — No locality given; Graham collected around Mexico City and in the mining districts of Tlalpuxahua and Real del Monte. — Holotypus, *Graham in 1830*, K!

Among herbaceous daleas *D. mucronata* is a giant, its stout red virgate stems, solitary in young plants but later several together, bearing aloft from one to almost two meters high their narrow panicles of disproportionately small heads. Its great stature, long stipules, ample short-acuminate leaflets of thick texture, densely conelike spikes of small shiny short-toothed calyces subtended by persistent, internally silky bracts, and its small, dingily ochroleucous petals all contribute to a unique facies. Rydberg (1920, p. 94) described *Parosela mucronata* as glabrous, but the plants are only rarely hairless when closely examined. The typus, part of a young plant with flowers not yet expanded, has thinly but obviously pubescent upper leaves, and traces of pubescence can be found in almost all specimens collected since. Densely pilosulous innovations arising late in the year from the base of main stems otherwise almost glabrous, reveal a latent potentiality for developed vesture. So far as known the calyx is always glabrous externally except for a crest of short hairs around the recessed dorsal sinus, but its mouth is silky-fringed within.

The typus of *D. aristata* Benth., a species overlooked by Rose and Rydberg, is characteristic. A record of *D. mucronata* from southwest Chihuahua (Gentry, 1942, p. 139) is based on a collection (*Gentry 2838*) of *D. leucostachya* var. *eysenhardtioides*.

IVC. (xiv). Series Cinnamomeae Barneby

Shrubs up to 2.5 m, flowering first when merely suffruticose, densely soft-pilosulous throughout; *leaflets* 9–15 pairs, flat, relatively ample (up to ± 1 cm), diminishing upward along rachis; *spikes* conelike; *bracts* persistent; *calyx-tube* strongly oblique at orifice, ± as long as dorsal tooth, the intercostal membranes charged with many glands, these at least in 2 ventral panels scattered or 2-seriate; *petals* concolorous, pinkish-brown fading cinnamon-brown, the funnel-shaped banner shorter than detached keel, the epistemonous petals low-perching, the keel-blades ± 3.5–4 mm long. — Sp. 1, of thorn-forest in the e. lobe of Balsas Depression, Puebla and Morelos.

Dalea subgen. **Parosela** sect. **Parosela** ser. **Cinnamomeae** Barneby, ser. nov. affinitatis dubiae sed inter *Tomentosas* ac *Pectinatas* quasi militans, illis forsan propior sed foliorum pube molli, foliolis multijugis, bracteis interfloralibus persistentibus necnon petalorum colore adhuc in genere haud obvia absimilis. — Sp. unica: **D. cinnamomea** Barneby.

A species of unknown kinship, *D. cinnamomea* resembles forms of *D. tomentosa* and *D. bacchantum* in the dense knoblike flower-spikes and in form and proportions of the calyx; but this has many glands in each intercostal panel of the tube and the leaves, with 9–15 rather than 2–5 or 6 pairs of leaflets, are substantially different. The foliage and calyx-glands suggest ser. *Pectinatae*, but *D. cinnamomea* differs from all of these in its tall shrubby habit of growth, conelike spikes, and persistent bracts. The soft pubescence of stems and foliage and the strange color of the petals, the banner in this case concolorous with wings and keel, contribute further to a pronounced individual facies. The species appears suffiently isolated to deserve special status within sect. *Parosela*.

100. Dalea cinnamomea Barneby

(Plate XCIII)

Slender, awkwardly branching shrubs up to 1–2.4 m tall, precociously flowering when suffruticose, the growth of the year rather densely leafy, densely and softly villosulous throughout with vertical or widely ascending hairs up to 0.4–1 (1.2) mm long, the young, virgately ascending, brown-purplish stems either simple or branched below middle, distally gland-verruculose and forking into a corymbose panicle of heads terminal to ± 2–7 branchlets, the young foliage ashen, in age greenish, the leaflets pubescent both sides, bright green beneath the vesture above, paler and punctate beneath; *leaf-spurs* very short; *stipules* linear-acuminate or -caudate, 1.5–4 mm long, verruculose, becoming dry and deciduous; *intrapetiolular glands* small, sometimes immersed; *post-petiolular glands* prominent, mammiform, orange; *leaves* subsessile, the main cauline ones divaricate or reflexed, 2–5.5 cm long, with narrowly margined, often incurved rachis and 9–15 pairs of rather crowded, oblong or oblong-obovate, obtuse and bluntly gland-mucronate or emarginate, mostly flat leaflets 4–11 mm long, gradually smaller upward, the uppermost leaves shorter, with fewer smaller leaflets; *peduncles* stout, 1–8 (10) cm long; *spikes* very dense, conelike, ovoid becoming ovoid-oblong, without petals 10–13 mm diam, the villosulous axis (1) 1.5–2.5 cm long; *bracts* persistent, rhombic-lanceolate, 4–6 mm long, the boat-shaped body submembranous, carinate dorsally, villosulous within and without, contracted into a lanceolate, gland-verruculose, livid, gland-tipped, sometimes glabrescent tail almost as long; *calyx* 4.7–6 mm long, villosulous with fine soft ascending hairs, the submembranous pallid tube thinly so, 2.5–3 mm long, the ribs slender, not prominent, the intervals charged with 1 (the ventral pair with ± 2) rows of 3–5 (7) honey-colored

glands, the herbaceous teeth strongly unequal, the dorsal one lanceolate, (2.1) 2.4–3 mm long, the lateral and ventral pairs much shorter, separated by rounded sinuses, the forked nerves below them intramarginal; *petals* pale pinkish-brown fading cinnamon-brown, the banner gland-tipped, the remainder glandless, the epistemonous ones perched low on the androecium, 1.8–2.8 above hypanthium; *banner* 4.5–5.3 mm long, the claw 2–3 mm, the funnel-shaped, nearly erect blade 2.5–3 mm long, 3–3.4 mm wide, emarginate at apex, recessed at base into a cornet; *wings* 4.5–5.2 mm long, the claw 2.1–2.3 mm, the elliptic blade 3.1–3.4 mm long, 1.6–2 mm wide; *keel* 5.5–6 mm long, the claws 2.1–2.3 mm, the blades 3.5–4.1 mm long, 2–2.4 mm wide; *androecium* 10-merous, 7.2–8.6 mm long, the longer filaments free for 1.8–2.5 mm, the connective gland-tipped, the brown anthers (0.65) 0.75–0.9 mm long; *pod* (not seen mature) ± 3 mm long, triangular in profile, the style-base terminal, the valves hyaline and glabrous at base, thinly herbaceous, barbate, and gland-sprinkled distally. — Collections: 4 (ii).

Hot brushy hillsides on volcanic bedrock, often entangled with spiny *Mimoseae*, 1170–1500 m (3900–5000 ft), local, known only from the hill-country s. of Izúcar de Matamoros in w. Puebla, and near Xochitepec in adjoining Morelos. — Flowering September to January. — *Material*: PUEBLA. Izúcar de Matamoros: Matamoros, *Miranda 2448* (MEXU); 7 mi s. of Izúcar, *Ripley & Barneby 14,568* (CAS, DAO, F, GH, MEXU, MICH, NY, UC, US). MORELOS. Xochitepec, *Lyonnet 869* (US).

Dalea cinnamomea (cinnamon-colored) Barneby, sp. nov., *D. tomentosae* (Cav.) Willd. ut videtur affinis, sed pube villosa nec sericea, foliorum majorum foliolis 9–15 (nec 2–5)-jugis sursum secus rachin decrescentibus, petalisque junioribus roseo-brunnescentibus cito cinnamomeis insigniter diversa. — Frutices 1–2.4 m altae graciles undique patentim villosulae; folia caulina patula 2–5.5 cm, foliolis planis inferne punctatis 4–11 mm longis; *inflorescentia* laxe corymbosa, pedunculis terminalibus 1–8 cm longis; *spica* ovoidea strobiliformis absque petalis 1–1.3 cm diam; *calycis* tubus parce villosulus dente dorsali subaequilongus, dentibus aliis multo brevioribus; *vexilli* lamina basi in puteolum recessa; *carinae* laminae ± 3.5–4 mm longae. — PUEBLA. Izúcar de Matamoros: 8 mi s.-e. of Izúcar de Matamoros, nov 7, 1964, *Ripley & Barneby 13,690*. — Holotypus, NY; isotypi, CAS, GH, K, MEXU, MICH, NY, US.

An ungainly but interesting shrub, notable for its soft villous pubescence and hard egg-shaped flower-spikes borne in loose, more or less corymbose panicles. The stems of young plants are virgate, herbaceous almost to the ground, but persist in the form of thin woody trunks bearing aloft succeeding generations of tender growth. In structure of calyx and petals *D. cinnamomea* resembles *D. tomentosa* and *D. leucosericea*, but differs from both in the quality of vesture, in the many leaflets, and in the extremely dense, conelike spikes. The paniculate arrangement of the inflorescence is emphatically unlike the narrow thyrse of the sympatric *D. tomentosa* var. *psoraleoides*, but not essentially different from that seen in the allopatric *D. tomentosa* var. *mota*, or sometimes in *D. leucosericea*. The color of the petals, suggesting a compromise between pink and brown or possibly pale yellow, has no match in *Dalea*, and the chemistry of the pigment would form an interesting subject of inquiry. It is a tempting hypothesis to derive *D. cinnamomea* from a cross between a pink-flowered and a yellow-flowered species, but there is no known candidate for the second role.

A single individual plant (*Ripley & Barneby 13,709*, CAS, NY) found near Tlaltizapán, Morelos, close to a colony of typical *D. leucosericea*, resembled *D. cinnamomea* so closely in habit and petal-color as to be taken for that species in the field, but is now interpreted as a probable hybrid involving *D. leucosericea*. More silky pubescence, barren axillary branchlets bearing short 7–11-foliolate leaves, and a less dense spike of more symmetrical calyces are all features suggesting this parentage.

IVC (xv). Series Psoraleoides (Rydberg) Barneby

Suffruticose often becoming shrubby, variable in habit and mode of branching, pilosulous or silky-villous throughout or rarely glabrescent; *stems* smooth or sparsely verruculose; *leaflets* of primary leaves 2–6 pairs, the larger leaflets at least 6 mm long (sometimes shorter in *D. greggii*); *spikes* either moderately dense or conelike, capitate to oblong; *bracts* either persistent through anthesis or held fast between crowded calyces; *calyx* either pubescent or (*D. tomentosa* var. *psoralesoides*) glabrous externally, the dorsal tooth usually shorter than tube, rarely up to 1 mm longer but the lateral ones then shorter; *petals* usually bicolored, the banner white or yellowish (rubescent), the epistemonous ones pink-purple, rarely all whitish. — Spp. 4, widely dispersed over temperate and arid-tropical Mexico, all represented by at least one form in Puebla or Morelos and adjoining states, 1 s.-e. to Nicaragua, 1 n.-w. to Pacific Sonora, 1 n. to trans-Pecos Texas.

Dalea subgen. **Parosela** sect. **Parosela** ser. **Psoraleoides** (Rydberg) Barneby, stat. nov., based on *Parosela* subgen. *Euparosela* XXIII. *Psoraleoides* Rydb., N. Amer. Fl. **24**: 90. 1920. — Sp. lectotypica: *P. psoraleoides* (Moric.) Rose = **Dalea tomentosa** var. **psoraleoides** (Moric.) Barneby.

A group of species no doubt genuinely allied, but one difficult to define neatly and not separable in absolute terms either from ser. *Versicolores* or ser. *Tuberculatae*. The prevailing syndrome of ser. *Psoraleoides* is a smooth stem combined with few (2–6) pairs of relatively large, densely pilosulous, never carnosulous leaflets and a relatively short-toothed calyx. The *Tuberculatae* with leaflets as few have prominently warty stems, or smaller, glabrescent leaflets, or both together. The *Versicolores* with similarly short-tooth calyx have more numerous leaflets, again smaller, carnosulous, or glabrescent, often all together. The nucleus of ser. *Psoraleoides*, as first formulated by Rydberg, is equivalent to the one polymorphic *D. tomentosa* of this account. The common aspects of *D. tomentosa* are notable for the shortening of the lateral branchlets of the whole inflorescence, which takes the form of a narrow thyrse of spikes, the first and terminal one of a given axis being raised above the rest. The discovery of *D. tomentosa* var. *mota*, unknown to Rydberg, which has a more normal, corymbose mode of branching, devaluated the habital character, and provided a passage to *D. bacchantum* and *D. leucosericea*, the latter referred by Rydberg to his *Versicolores*. Modern collections have shown further that *D. leucosericea* and *D. greggii* are morphologically confluent where their ranges overlap in southern Mexico, and no taxonomic arrangement that sundered this pair of species, or *D. leucosericea* from *D. bacchantum*, could be acceptable. The introduction to ser. *Psoraleoides* of *D. greggii*, which would be sought, in its more verruculose forms, in ser. *Tuberculatae* and, in its forms with longer calyx-teeth, in ser. *Versicolores* (and will be found keyed under both), makes a sharp definition of the series impossible in practice.

Key to the Species of Ser. *Psoraleoides*

1. Inflorescence usually thyrsiform, the terminal (central) spike of each major stem-axis elevated above the lateral spikes, these borne serially one above another on short branchlets (but inflorescence corymbose in var. *mota* of the Pacific slope in s. Sonora and Sinaloa); *interfloral bracts* glabrous internally; *flowers* small, the calyx mostly 2.5–4 (4.3) mm, the keel-blades 2–4 (mostly less than 4) mm long; *stems* erect, suffruticose becoming shrubby or subarborescent; widespread from Nicaragua n. to Sonora and Tamaulipas, lacking on the Mexican Plateau proper. 101. *D. tomentosa* (p. 401)

1. Inflorescence not thyrsiform but usually corymbose, the terminal spike of each major axis surpassed by one or more lateral spikes (if not so, the stems diffuse or arcuately procumbent); *interfloral bracts* pubescent internally; *flowers* mostly larger, always so where sympatric with *D. tomentosa*, the calyx mostly 4.2–6 mm, the keel-blades (3.8) 4–6 mm long, the low measurements mostly in plants of the Mexican Plateau.
   2. Stems virgately ascending or erect, 5–20 dm tall, everrucose or almost so; plants of s. Mexico (Morelos and Puebla to Guerrero and Oaxaca).
      3. Mature leaves greenish-pilosulous, pubescent with hairs mostly less than 1 mm long; *spikes* permanently dense, hard and conelike; cliffs of volcanic manadnocks, local in Morelos. 102. *D. bacchantum* (p. 406)
      3. Mature leaves densely silvery-pilose, the longer hairs at least 1 mm long; *spikes* moderately dense, not conelike; bluffs and hilltops, never on cliffs, usually on limestone, local from s. Puebla and Morelos to adjoining Guerrero and centr. Oaxaca. 103. *D. leucosericea* (p. 407)
   2. Stems diffuse and procumbently arcuate, often tip-rooting, rising less than 5 dm from ground-level, usually less than 5 dm long, either smooth or sparsely low-verrucose; widespread over the Mexican Plateau, n. into trans-Pecos Texas, n.-w. to the Coastal Plain in Tamaulipas, s. interruptedly along w. edge of the plateau to desert enclaves in Puebla and Oaxaca, there passing into the preceding. 104. *D. greggii* (p. 409)

101. DALEA TOMENTOSA (Cavanilles) Willdenow
(Plate XCIV)

Erect suffrutescent herbs becoming shrubby and up to 2 m tall, sometimes precociously flowering when (3) 5–10 dm, commonly monopodial and virgately branching distally, pilosulous throughout or nearly so, the smooth or very sparsely verruculose, green or castaneous stems at first shaggy with spreading-ascending hairs up to 0.5–1 (1.2) mm long, when old furrowed and striped, eventually glabrate, the foliage silky with ascending or subappressed, often shorter hairs, green, greenish-cinereous, or gray-silky, the leaflets punctate beneath, the inflorescence most commonly a narrow thyrse of spikes terminal to short, ascending, leafy lateral spurs (these all shorter than the primary axis and the central-terminal spike therefore surpassing all the rest), the lateral branches in var. *mota* elongating, the inflorescence then a broadly pyramidal panicle; *leaf-spurs* 0.5–1 (1.5) mm long; *stipules* narrowly subulate or subsetiform, 1.5–3.5 (5) mm long, livid, pubescent, each with a gland at base; *intrapetiolular glands* 0 or minute; *post-petiolular glands* prominent, conic, often concealed by vesture; *leaves* short-petioled or subsessile, ± dimorphic, the primary cauline ones (1) 1.5–2.5 (3.5) cm long, with 2–4 (5) pairs of oblanceolate, elliptic-oblanceolate, rarely obovate-cuneate or obovate, acute, short-acuminate, obtuse and abruptly acuminulate, rarely emarginate, loosely folded, flat, or flat and marginally involute leaflets 3–11 (14) mm long, the larger on any plant at least 6 mm long, the terminal leaflet often a trifle larger than the last pair, with them forming a palmate trefoil; *peduncles* all terminal to leafy branchlets, (0) 3–15 (25) mm long; *spikes* very dense or at least becoming so in fruit (in var. *tomentosa* some of the lowest flowers sometimes visibly separated from their neighbors but the rest contiguous), narrowly ovoid to conic becoming narrowly oblong-cylindroid or rarely subglobose, without petals 6.5–12 mm diam, the villosulous, pitted axis finally 1–2.5 (3) cm long; *bracts* deciduous but often held fast between the calyces, lanceolate or narrowly ovate-acuminate, 2–3.5 (4) mm long, firm, obscurely gland-sprinkled, dorsally pilosulous with sometimes glabres-

cent tips, glabrous within; *calyx* 2.6–4.3 mm long, varying from densely pilosulous externally to glabrous except for the teeth and orifice, the firm tube brown, pallid, or livid, 2–2.6 mm long, shallowly recessed behind banner or the whole orifice oblique, the ribs filiform, immersed or nearly so, the subulate teeth unequal, the dorsal one 0.6–1.6 (2) mm long, the rest a little broader and shorter; *petals* variable in color, the whitish banner early rubescent, glandless or charged near the greenish eye-spot with 1–2 very small glands, the epistemonous ones whitish, pink, lilac, or purple, glandless, perched near middle or well below middle of androecium; *banner* 3.1–5 mm long, the claw 1.5–2.5 mm, the deltate-cordate, often hooded blade 1.5–2.8 mm long, 1.6–3 mm wide; *wings* 2.1–4.3 mm long, the claw 0.4–1.1 mm, the elliptic-oblong blades 1.7–3.5 mm long, 0.8–1.7 (2) mm wide; *keel* 2.6–4.6 (5.1) mm long, the claws 0.7–1.2 (1.7) mm, the blades 2.1–3.9 mm long, 1.2–2.1 mm wide; *androecium* 10-merous, 3.5–7 mm long, the longer filaments free for 0.5–1.8 mm, the connective gland-tipped, the anthers 0.2–0.45 mm long; *pod* obovate in profile, 1.9–2.3 mm long, the style-base latero-terminal, the convexly arched, subfiliform prow prominulous, the valves hyaline and glabrous at base, thence thinly papery, distally pilosulous and charged with a few small glands or glandless; *seed* ± 1.3–1.5 mm long.

Among erect shrubby daleas of North America *D. tomentosa* sens. lat. is characterized by the following diagnostic syndrome: stems densely pubescent but scarcely verruculose; leaflets few (2–5 pairs) and relatively ample; spikes very dense; small calyces (less than 4.5 mm) and proportionately small petals (keel-blades 2–4 mm). The commoner forms of the species, widespread through southern Mexico and Central America, are intuitively recognized by the arrangement of the spikes, the central one being elevated above all the rest which are terminal to a succession of short axillary branchlets and together form a narrowly pyramidal or oblong thyrse (cf. Pl. CXIV). In these forms the foliage though densely pubescent is usually greenish, whereas in var. *mota*, a comparatively rare plant of the Pacific slope in northwestern Mexico, the leaves are permanently silvery-villosulous and the lateral axillary branchlets are both fewer and longer, raising some spikes of the second order to the level of the central one, so as to form a more open cymose panicle. All sympatric relatives of *D. tomentosa* southward from the Neovolcanic Belt in Mexico are, if at all similar in habit, substantially larger-flowered.

Key to the Varieties of *Dalea tomentosa*

1. Calyx thinly pilosulous externally or glabrous below the teeth, the longest hairs not over 0.7 mm long, the vesture not concealing the surface of tube; *spikes* up to 9 mm diam (without petals); *inflorescence* of (7) 10 0r more spikes arranged in a narrow thyrse; widespread from the Neovolcanic Belt s.-ward, in Mexico n. to extreme s. Tamaulipas and s. Sinaloa.
   2. Calyx-tube pilosulous; *inner petals* pink to purple, relatively large, the keel-blades 2.8–3.8 mm long, 1.6–2.1 mm wide; *androecium* 0.5–0.7 cm long; s. Tamaulipas to Veracruz, and disjunctly in Jalisco and Nayarit. 101a. var. *tomentosa*.
   2. Calyx-tube glabrous, vernicose; *inner petals* smaller, white or faintly pink-tinged, the keel-blades 2.1–2.6 mm long, 1.2–1.5 mm wide; *androecium* 0.35–0.55 cm long; Jalisco to s.-e. México, s. and e. to Nicaragua, extending feebly n. from Jalisco into s. Sinaloa. 101b. var. *psoraleoides*.

1. Calyx densely shaggy-villosulous throughout, the longer hairs up to 1–1.4 mm long, the vesture concealing all but tips of teeth; *spikes* 1–1.2 cm diam; *inflorescence* a loose, broadly pyramidal or flat-topped panicle of relatively few (up to 7) spikes, or the spikes solitary; s. Sonora to centr. Sinaloa on w. slope of Sa. Madre. 101c. var. *mota*.

101a. DALEA TOMENTOSA (Cavanilles) Willdenow var. TOMENTOSA
(Plate XCIV)

Up to 2 m tall when adult, sometimes flowering precociously; *foliage* densely softly pubescent when young, green or greenish in age; *calyx* and *petals* as given in key. — Collections: 28 (ii).

Open hills, among shrubbery or standing free in grassland, ascending into oak woodland or thin pine-forest, 1020–2240 m (3400–7800 ft), locally abundant, of bicentric range in e.-centr. and w.-centr. Mexico: Gulf slope of the plateau in Veracruz and s. Tamaulipas; hill country of w. Jalisco and s. Nayarit, from Cerro San Juan and Volcán Ceborucu s. to Sierra del Cuale, and upstream along Río Santiago to Guadalajara. — Late September to January — *Representative*: NAYARIT: *Ripley & Barneby 14,049* (NY); *Mexia 899* (NY); *Ferris 5906* (US); *Paray 3413* (ENCB). JALISCO: *Pringle 2471* (BR, M, NY, W), *11,809* (ARIZ, F, L, M, OKLA); *Gentry 5349* (ARIZ, NY); *Rose & Painter 7552* (NY, US); *Breedlove 18,679* (NY); *Ripley & Barneby 14,055* (NY). TAMAULIPAS: typus of *D. argentea* Mart. VERACRUZ: *Purpus 2347* (F, NY, UC, Z), *10,814* (M, US), *14,214* (F, UC); *Liebmann 4603* (F, UC); *Galeotti 3268* (BR, W).

Dalea tomentosa (Cav.) Willd., Sp. Pl. **3**: 1341. 1801, based on *Psoralea tomentosa* Cav., Ic. **3**: 21, Pl. 240. 1794. — "Habitat in Mexicano Imperio. Floruit mense Decembri 1793 in Regio hort. Matritensi." — Holotypus, labelled "*Psoralea praecox orgyalis* N.E. ex desertum Sancti Angel" and (another ticket) "ex Mexico, culta in hort. R. 1794," MA (herb. Cav.)! — The specimen is probably cultivated, the designation of locality at San Angel in Valley of Mexico irrelevant, unless the seed came from plants grown there by Maldonado. — *Parosela tomentosa* (Cav.) Rose, Contrib. U. S. Nat. Herb. **12**: 273. 1909.

Dalea verbenacea (resembling some *Verbena* or *Lippia*) Schlechtd. & Cham., Linnaea **5**: 579. 1830. — "Prope Jalapam in apricis. Aug. Hacienda de la Laguna [in foothills of Cofre de Perote], Oct." — Holotypus, *Schiede & Deppe 615*, formerly B; isotypi, some labelled "in temperatis Prov. Verae Crucis, Oct. 28," presumably from Hacienda de la Laguna, F (fragm), L, NY, W!

Dalea verbenacea var. *sericea* (silky, of the foliage) Schlechtd. & Cham., Linnaea **5**: 579. 1830. — Data as for the preceding. The two were distinguished in the field by Schiede & Deppe, but whether they were found together or the present one only at Jalapa in August is not on record.

(?) *Dalea argentea* (silvery) G. Don, Gen. Hist. Dichl. Pl. **2**: 225. 1832. — "Native of Mexico, near Jalapa...(v. s. herb. Lamb.)." — No typus known to survive, but the short description and locality suggest no other species.

Dalea argentea (silvery, of the leaflets) Mart., "Del. Sem. Hort. Monac. 1846." Walp., Ann. **1**: 228. 1848. — "Crescit in Mexico ad La Miquiquana." — Holotypus, labelled "Mexica La Miquaquana *Karwinski* n. mon. jul. 1846", BR (herb. Mart.)! = NY Neg. *N. S. 6350*.

Because of its relatively big (though in context of the genus small) flowers, var. *tomentosa* is the more decorative form of the species. The foliage varies in density of pubescence, the larger adult leaves being either silvery or green beneath the vesture. The petals vary in depth of coloring from vivid purple to rosy lilac, this range being recorded even in one locality in Nayarit (*Mexia 899*). The bicentric dispersal raises a question as to whether the variety as defined herein is a monophyletic entity or consists on the contrary of two independent but parallel derivatives of the commoner and more widespread var. *psoraleoides*. The material of var. *tomentosa* from the Gulf slope tends to have slightly looser flower-spikes than plants from western Mexico and may often be recognized by this feature; the difference is, however, very slight. The holotypus of the species being a garden plant grown under somewhat unnatural conditions cannot be identified to probable origin although, from the accessibility of plants on the old highway from Veracruz up to the plateau it seems likely that seeds may have come from this region.

101b. Dalea tomentosa (Cavanilles) Willdenow var. psoraleoides (Moricand) Barneby

(Plate XCIV)

Essentially as var. *tomentosa* except for the (nearly always) externally glabrous calyx-tube, small whitish or faintly pink-tinged petals, and short androecium. — Collections: 78 (viii).

Brushy and grassy hillsides, ascending into oak-woods or rarely into the pine belt, 600–2100 m, exceptionally lower (to 80 m on river sands of Río Motagua in Izabal, Guatemala), widespread and common, though often appearing as individuals rather than in colonies, in the Neovolcanic Belt from the basin of Lago Chapala, Jalisco, to s. México and Morelos; Sierra Madre del Sur in Guerrero and Oaxaca, and thence through the highlands of Chiapas, s. Guatemala (especially common), and Honduras, to Estelí, Nicaragua; in Mexico also apparently disjunct on the w. slope of Sierra Madre Occidental in s. Sinaloa. — September to February. — *Representative*: MEXICO. Sinaloa: *Ripley & Barneby 14,020* (CAS, NY); *Ortega 5295* (MEXU). Jalisco: *McVaugh 13,324* (MEXU). Michoacán: *Ripley & Barneby 13,394* (MEXU, NY, US), *14,104* (NY). Morelos: *Pringle 9044* (F, MEXU); *Ripley & Barneby 14,555* (NY). Guerrero: *Hinton 9598* (F, NY), *11,527* (NY, RENNER, UC, US). Oaxaca: *Galeotti 3159* (BR); *Franco in 1842* (W). Chiapas: *Alush Shilom Ton 403, 1247* (US); *Laughlin 473* (US). GUATEMALA. Huehuetenango: *Steyermark 51,747* (F). Baja Vera Paz: *Kellerman 6344* (F, US). Izabal: *Steyermark 38,297* (F). Zacapa: *Steyermark 42,691* (F, NY). Sacatepéquez: *Steyermark 59,225* (F). Sololá: *Kellerman 6357* (F, US). Guatemala: *Molina 13,470* (F). Jalapa: *Standley 76,754, 77,116* (F). Chiquimula: *Steyermark 30,654* (F). Jutiapa: *Steyermark 32,023* (F). HONDURAS. Comayagua: *Standley & Chacon 6932* (F). F. Morazán: *Molina 8792* (F). El Paraíso: *Williams & Molina 11,202* (F, NY). NICARAGUA. Estelí: *Williams & Molina 20,169* (NY, WIS).

Dalea tomentosa (Cav.) Willd. var. **psoraleoides** (Moric.) Barneby, comb. nov., based on *D. psoraleoides* (resembling some *Psoralea*) Moric., Mém. Soc. Genève **6**: 533, tab. IV. 1833. — "Hab. in Mexico prope Cuernavaca." — Holotypus, *Berlandier 1027*, collected Oct 12, 1827, G! isotypi, OXF, W! — *Parosela psoraleoides* (Moric.) Rose, Contrib. U. S. Nat. Herb. **10**: 104. 1906 ("*psoralioides*"). *Parosela tomentosa* var. *psoraleoides* (Moric.) Macbr., Contrib. Gray Herb., New Ser. **65**: 18. 1922.

Dalea vulcanicola (from the habitat) Donn. Sm., Bot. Gaz. **56**: 52. 1913. — "Volcán Atitlán, Depart. Sololá, Guatemala, Febr. 1906, *W. A. Kellerman n. 5780...*" — Holotypus, US!

Petalostemon chiapense (of Chiapas) T. Brandg., Univ. Calif. Pub. Bot. **10**: 408. 1924. – "Collected in mountains near Hacienda Monserrate, Chiapas. [*Purpus*] No. 9142." – Holotypus, collected in Sept 1923, UC! isotypi, F, GH, MEXU, NY, US!

A coarse plant but inconspicuous, the tiny, whitish or dimly pink flowers transient and little exserted. Although adult plants become decisively shrubby or even arborescent, with a thin crooked trunk, growth is rapid and the first flowers are ordinarily produced at the close of the first season. At this stage the plant consists of a single leafy virgate stem bearing from the middle upward a succession of short branchlets, each terminating in a spike of flowers. The following year several stems may arise from the trunk close to the ground, especially if the primary leader is cut or damaged, but more often much of the primary axis persists, becoming woody and striped lengthwise, and gives rise distally to one or several virgate panicles, each equivalent to that of the first season. Later on the plants become irregularly branched, but the panicle of spikes, at whatever level it may originate, remains essentially uniform.

The var. *psoraleoides* is extremely common in the highlands of Guatemala and again along the south slope of the Neovolcanic Belt in Mexico. At about the longitude of Lago Chapala in eastern Jalisco it is abruptly replaced by var. *tomentosa*, but then reappears, beyond the range of var. *tomentosa*, in quite typical form, on the Pacific slope in southern Sinaloa. Probably var. *tomentosa* is the derived form which has become dominant in a small enclave within the range of the species.

101c. DALEA TOMENTOSA (Cavanilles) Willdenow var. MOTA Barneby (Plate XCIV)

Up to 1–1.2 m tall, the virgate, purplish, shaggy-pilosulous stems branching distally into a relatively few-headed and open panicle of subglobose or shortly and plumply oblong spikes, these broad in context of the species, short secondary branchlets developing, if at all, only late in the season; *bracts* and calyx densely silky-barbate throughout; *flowers* in the size-range of var. *tomentosa*; *calyx* 4–4.3 mm, the tube 2–2.4 mm, the dorsal tooth 1.6–1.8 mm long; *banner* 3.7–4.6 mm long; *keel* 4.5–5.1 mm long, the claw 1.7 mm, the blades 2.9–3.4 mm long, 1.8–2 mm wide; *androecium* 5–5.5 mm long, bearing the epistemonous petals at points 1.3–1.7 mm above hypanthium. — Collections: 5 (o).

Arid or sometimes moist rocky hillsides in oak-pine and oak-madroño woodland, sometimes on limestone, 1200–1740 m (4000–5800 ft), local, w. slope of Sierra Madre Occidental in s. Sonora (Sas. Charuco and Saguaribo and vicinity, on Río Mayo) and n. Sinaloa (Sa. Surutato). — Flowering late October to March. — *Material*: SONORA. Alamos: Canelas, *Gentry 2021* (F, GH); Curohui, Río Mayo, *Gentry 2143* (ARIZ, F, K, MEXU, UC). SINALOA. Sinaloa de Leyva: n.-w. of Los Ornos, *Breedlove & Kawahara 17,080* (NY). Badiraguato: Los Ornos, *Breedlove & Kawahara 16,806* (NY).

Dalea tomentosa (Cav.) Willd. var. **mota** (the vernacular name) Barneby, var. nov., quoad florum magnitudinem coloremque cum var. *tomentosa* congruens sed panicula pauci-capitata aperte corymboso-cymosa nec thyrsiformi, spicis latiusculis 10–12 (nec ± 7–9) mm diam., et praesertim calyce toto longe densissime barbato-piloso, pilis sericeis saltem 1 mm longis absimilis. — SINALOA. Badiraguato: open calcareous slopes in oak forest, 4000 ft., Tierra Blanca, March 4, 1940, *Howard Scott Gentry 5804*. — Holotypus, NY; isotypi, ARIZ, MICH.

The cited collection from Curohui, Sonora, dating back to 1935, was examined by Standley and annotated as representing a new species. The name was left unpublished, but the epithet *mota*, heard in Sonora by Gentry, is appropriately taken up even if at a

lower taxonomic level. Gentry's collections were all distributed as *D. tomentosa* with mark of interrogation, expressing the affinity of the plant and recognition of its distinctness. On account of the relatively few and plumply oblong or subglobose flower-spikes arranged in an open panicle rather than a narrow thyrse, var. *mota* is immediately distinguishable from var. *tomentosa*, but there seem to be no solid differential characters in the flower or foliage. Shorn of its beautiful silky-barbate vesture the calyx of var. *mota* is essentially like that of var. *tomentosa*. Furthermore, late in the year's growth-cycle some short leafy branchlets are developed below the primary panicle, these closely resembling the short-shoots in the thyrse of var. *tomentosa* and var. *psoraleoides*. It is noteworthy that the last-named occurs shortly southward from Sierra Surutato on the main range of Sierra Madre east of Mazatlán, whereas var. *tomentosa,* which it more closely resembles in size and coloring of the flowers, is not known from north of Tepic in Nayarit. Thus var. *mota* is greatly isolated from the aspect of *D. tomentosa* to which it appears most nearly related. The dense silvery pubescence of the leaves somewhat suggests the kindred *D. greggii* but the whole habit of the plant is so different that a genuinely close relationship seems unlikely.

102. Dalea bacchantum Barneby

(Plate XCV)

Shrubs 0.7–2 m tall, with openly and freely branching virgate stems forking distally into panicles of (1) 3–5 flower-spikes, pilosulous-strigulose almost throughout with fine hairs up to 0.5–0.7 mm long, the young stems densely (and under the heads shaggily) so, the older stems glabrate, livid-castaneous, becoming ridged and verruculose, the foliage greenish- or at first silvery-silky, the leaflets pubescent both sides, punctate beneath; *leaf-spurs* up to 1.2 mm long; *stipules* subulate to linear-caudate, 1–5 mm long, stiff, pubescent; *intra-* and *post-petiolular glands* rounded, prominent, brown or livid; *leaves* shortly petioled, the main cauline ones (2) 2.5–4 (4.5) cm long, with (3) 4–6 pairs of oblanceolate to oblong-elliptic, flat or loosely folded, dorsally keeled, mostly obtuse but gland-mucronulate leaflets 5–11 mm long, each subtending a branchlet or leafy spur clothed in leaves of the same type but smaller; *peduncles* terminal to major and to minor lateral axes, 0.2–5 cm long; *spikes* very dense, ovoid or oblong-ovoid, without petals 9–10 mm diam, the pilosulous axis 1–4 (4.5) cm long; *bracts* deciduous (sometimes held fast between flowers), narrowly ovate to narrowly lance-acuminate, (2) 2.5–5 mm long, the firm outermost ones shortest and broadest, the interfloral ones papery at base, firm distally, with slenderly subulate livid tips, all pilosulous dorsally, densely silky within; *calyx* 4.2–5.5 (5.8) mm long, softly densely pilosulous with ascending hairs up to 0.7–1 mm long, the tube 2.3–2.8 mm long, recessed behind the banner, the ribs slender but prominulous in age, subconcolorous, the membranous intervals charged with 1–3 small pale yellow glands visible from within, the firm, triangular-subulate teeth unequal, the dorsal one longest, 1.9–2.7 (3) mm long (0.2 mm longer to 0.7 mm shorter than tube); *petals* bicolored, the banner opening whitish-creamy, rubescent, the epistemonous ones lavender-purple, perched low on the androecium (1.2–2.2 mm above hypanthium), all glandless, or exceptionally minutely gland-tipped; *banner* 5–6.6 mm long, the claw 3–3.2 mm, the hooded, deltate-cordate blade 3–3.4 mm long, 3.6–4.2 mm wide, recessed at base into a cornet; *wings* 5–6.4 mm long, the claw 1.3–1.9 mm, the blade 4–5 mm long, 2.1–3 mm wide; *keel* 7.5–9 mm long, the claws 2.8–3.6 mm, the blades 4.6–6 mm long, 2.4–3.4 mm wide; *androecium* 10-merous, 7.5–9.2 mm long, the longer filaments free for 2.3–3 mm, the connective gland-tipped, the anthers 0.7–0.8

mm long; *pod* ± 2.7 mm long, obliquely triangular-obovate in profile, the style-base terminal but eccentric, the valves glabrous and hyaline at base, thence papery and densely villosulous. — Collections: 3 (ii).

Cliff-ledges, sometimes seeding down into thinly wooded ravines, 1620–1950 m (5400–6500 ft), locally abundant on the volcanic knobs around the village of Tepoztlán, Morelos. — Flowering October to January. — *Material*: MORELOS. Tepoztlán: volcanic monadnock above Tepoztlán, *Gentry, Barclay & Arguelles 19,580* (RENNER, US); knobs s. of Tepoztlán, *Ripley 14,901* (CAS, DAO, MEXU, MICH, NY, US), topotypi.

Dalea bacchantum (from the type-locality, site of prehistoric cult of Tepoztecatl, the Aztec Bacchus) Barneby, sp. nov., ab affini *D. tomentosa* (Cav.) Willd. imprimis foliolis plerisque 4–6 (nec 2–4)-jugis, necnon floribus majoribus in spicam densissimam strobiliformem confertis, ab ejus var. *psoraleoidi* (sola sympatrica) insuper petalis multo amplioribus purpureis spicisque modo corymboso nec thyrsoideo paniculatis diversa. — Frutices 2 m usque altae undique praeter caules vetustiores pilosulae; *folia* majora plerumque 2.5–4.5 cm longa, foliolis 4–6-jugis oblanceolatis 5–11 mm longis; *spicae* oblongo-ovoideae 1–4 cm longae, petalis delapsis 9–11 mm diam; *calycis* tubus ± 2.5 mm dente dorsali paullo longior vel brevior; *vexilli* lamina primo albida mox rubescens in puteolum basi excavata; *carinae* purpureae lamina 4.6–6 mm longa. — MORELOS. Tepoztlán: volcanic knobs s. of the village of Tepoztlán, nov 9, 1966, *Ripley & Barneby 14,540*. — Holotypus, NY; isotypi, CAS, F, GH, K, MEXU, MICH, NY, UC, US.

The specimens of *D. bacchantum* that first came to my attention (*Gentry et al. 19,580*, US, collected in 1961) were interpreted provisionally as representing a variety of *D. tomentosa*, though obviously not a described one. My evaluation of its affinity still seems sound, but after field experience of the plants in their rather dramatic habitat on the cliff-faces at Tepoztlán, I feel that they have diverged too far, morphologically and ecologically, from *D. tomentosa* to be accommodated therein with any comfort. The more numerous leaflets, mostly 4–6 (not 2–4) pairs in the major stem-leaves and the relatively large showy flowers stand far outside the known limits of variation in *D. tomentosa* sens. lat.; while the sympatric (but ecologically unspecialized) *D. tomentosa* var. *psoraleoides*, which is found at Tepoztlán on brushy slopes beneath the cliffs, is emphatically different in its tiny whitish petals and in the thyrsoid, not corymbose deployment of the flower-spikes. The corymb is not in itself an important differential character, as it reappears in the distantly allopatric *D. tomentosa* var. *mota*, but there combined with a characteristic white-silky pubescence and once again by tiny flowers. In the accompanying plate *D. bacchantum* is paired with the also related *D. leucosericea*, similar in leaflet-number but less so in general aspect, being white-silky throughout with long lustrous hairs. The spike is only moderately dense, flexible and not hard or conelike as that of *D. bacchantum*, and composed of smaller, paler, less exserted flowers. The habitat of *D. leucosericea* is different also; it is never a cliff plant but found on open hilltops and eroded badlands, usually and perhaps exclusively on calcareous strata.

103. DALEA LEUCOSERICEA (Rydberg) Standley & Steyermark (Plate XCV)

Suffruticose or weakly shrubby in age, up to 5–12 (15) dm tall, silky-villous nearly throughout with fine spiral hairs up to 0.8–1.3 mm long, the several or numerous virgately ascending, simple or remotely and sparingly branched, almost or quite glandless stems shaggy-pilose when young becoming brown and furrowed and finally gla-

brate in age, the main cauline leaves all or mostly subtending leafy spurs some of which develop distally into monocephalous branchlets, the foliage lustrously pilose with forwardly ascending or subappressed hairs, the leaflets equally pubescent both sides but sometimes greenish above, punctate under the vesture beneath; *leaf-spurs* 0.5–1.2 mm long; *stipules* narrowly lanceolate or subulate, 1.5–4 (5) mm long, becoming dry and castaneous, densely pilosulous dorsally, glabrous within; *intrapetiolular glands* 1–3, spiculiform; *post-petiolular glands* small, prominent but concealed by hairs; *leaves* subsessile or very shortly petioled, the main cauline ones (1) 1.5–3 cm long, with narrowly margined rachis and 3–5 pairs of oblong-obovate or obovate, abruptly short-acuminate, or obtuse and gland-mucronulate leaflets (5) 6–11 mm long, the spur-leaves smaller but of same type; *peduncles* forming, according to development of branchlets, either an open corymb or a narrow panicle, the primary ones up to 3.5 cm long, the lateral often subobsolete; *spikes* dense but not conelike, the larger ones becoming cylindroid, without petals 8–13 mm diam, the villosulous axis (1) 1.5–6.5 cm long; *bracts* persistent or tardily deciduous, lanceolate or lance-acuminate, 4–6.5 (7.5) mm long, castaneous or green with commonly livid tips, pilose and ± glandular dorsally, thinly appressed-silky within; *calyx* 5–6.6 mm long, silky-pilose or -plumose with loosely ascending or spreading hairs up to 0.8–1.6 mm long, the tube 2.5–3 mm long, recessed behind banner and orifice therefore oblique, the ribs slender becoming prominulous, usually golden-brown, the narrow lateral and dorsal intervals charged with 1 row of 3–5 small, transparent or pale yellow glands, the ventral intervals with more numerous scattered ones, the stiff, lanceolate or subulate, brown or livid teeth unequal, the dorsal one longest, 2.5–4 mm long, all gland-spurred; *petals* bicolored, the banner opening whitish or creamy with greenish-cream eye, early rubescent, the epistemonous ones rose or pinkish-lavender, the keel pale-edged externally, these perched low on the androecium (1.3–2 mm above hypanthium), all glandless or the keel and banner sometimes charged with tiny subapical gland; *banner* (4.7) 4.9–6.5 mm long, the claw (2.5) 2.7–3.2 mm, the ovate-cordate blade recurved through ± 40°, 2.5–3.4 mm long, 2.8–4.3 mm wide; *wings* (4.3) 4.9–6.5 mm long, the claw (1.1) 1.3–2 mm, the blades 3.2–5.5 mm long, 1.5–2.2 (2.5) mm wide; *keel* (5.7) 6–8.3 mm long, the claws (1.9) 2.3–3.2 mm, the blades 3.8–5.3 (6) mm long, 2.4–3.2 (3.8) mm wide; *androecium* 10-merous, 6.7–9 mm long, the longer filaments free for (1.9) 2.4–3 mm, the connective gland-tipped, the anthers 0.6–0.8 mm long; *pod* (little known) apparently as in *D. greggii*; 2n = 14 (Mosquin). —Collections: 17 (vi).

Barren hilltops, knolls, eroded bluffs, and openings in brush, nearly always on limestone, perhaps sometimes on white pumice-sands, 1110–1890 m (3700–6300 ft), ascending in Mixteca Alta into open oak woodland up to 2130 m (7100 ft), local but forming colonies conspicuous because of the white-silky foliage, scattered around the e. periphery of Balsas Depression in Morelos, e. Guerrero, and s. Puebla, s.-e. through the Mixteca country into the valley of Oaxaca; erroneously reported from Guatemala. —Flowering November to February. —*Representative*: GUERRERO. Chilpancingo: *Polito ES 1816* (ENCB). MORELOS. Tlaltizapán: *Ripley & Barneby 13,710* (CAS, MEXU, NY, US). PUEBLA. Petlalcingo: *Ripley & Barneby 13,679* (NY); Chila: *Ripley & Barneby 14,579* (CAS, MEXU, NY, US), *Miranda 2767* (MEXU). OAXACA. Huajuapan de León: *MacGregor 1627* (US); Nochixtlán: *Ripley & Barneby 14,605* (CAS, NY, US); Etla: *Ripley & Barneby 14,660* (NY); Ejutla: *Conzatti* 1627 (US); Mitla: *Ripley & Barneby 14,616* (CAS, MEXU, MICH, NY, US).

Dalea leucosericea (Rydb.) Standl. & Steyerm., Field Mus. Bot. Ser. **24**[5]: 213. 1946, based on *Parosela leucosericea* (white-silky) Rydb., N. Amer. Fl. **24**: 104. 1920. — "Type collected on hills near Tula, Oaxaca, May 20, 1906, *Pringle 13866*..." — Holotypus, US!

Dalea loesenerana (Ludwig Eduard Theodor Loesener, 1865–1941) Harms, Verh. Bot. Ver. Brandenb. **65**: 88. 1923 ("*Loeseneriana*"). — "Habitat in Mexico in prov. Oaxaca, in distr. Nochistlan, in Canada supra El Parian: Seler n. 1523." — Holotypus, formerly B, destroyed; isotypus, *C. & E. Seler 1523*, collected 27 Nov 1915, US!

104. DALEA GREGGII Gray
(Plate XCVI)

Slender subshrubs, colonial by means of arching, tip-rooting stems, forming subprostrate mats or low thickets rising to 3 (5) dm from ground-level, the old stems castaneous or blackish, often glabrate, the young, smooth or sparsely low-verruculose stems and the foliage densely silky-pilosulous with subappressed, loosely ascending, or (especially the stems) spreading and shaggy hairs up to 0.35–0.75 mm long, the leaves silvery or silvery-villous (sometimes tarnishing in herbarium), the primary cauline ones subtending short-shoots or fascicles of smaller ones; *leaf-spurs* 0.4–1 mm long; *stipules* subulate, lanceolate, or linear, chartaceous, livid or castaneous, 1–2.5 (3) mm long, pubescent dorsally, glabrous or glabrate within; *intrapetiolular glands* 2, setiform; *post-petiolular glands* small, often concealed by vesture; *leaves* shortly petioled or subsessile, the primary cauline ones 0.6–2.5 (3) cm long, with narrowly thick-margined rachis and 2–4 pairs of broadly to narrowly obovate to broadly oblanceolate, commonly emarginate, sometimes gland-mucronate or abruptly short-acuminate, flat or loosely folded leaflets 2–7 (9) mm long, the terminal one sessile, the leaves of axillary spurs similar but in all parts smaller; *peduncles* 0–4 (6) cm long, those terminal to primary axes mostly pedunculate, those terminal to branchlets mostly sessile or nearly so; *spikes* dense but not conelike, subglobose to ovoid becoming ovoid to shortly oblong-cylindroid, without petals 8–11 mm diam, the pilosulous axis finally 0.4–3, exceptionally up to 5.5 cm long; *bracts* persistent through anthesis, deciduous with the ripe fruit, ovate to lance-acuminate or linear-elliptic, 2–4 mm long, the broader ones ± navicular at base, the rest flat or nearly so, all subherbaceous becoming stiffly papery, glandular but the glands often concealed dorsally by the dense pubescence of subappressed or spreading, silky hairs, the inner face silky-strigulose; *calyx* (4) 4.2–6 mm long, densely silky-pilosulous with spreading hairs, the tube (2) 2.2–2.8 (3) mm long, the slender ribs becoming prominent, the thin but not hyaline intervals charged with 3–8 (10), when few 1-seriate, when many scattered, minute transparent or larger golden glands, the deltate-acuminate to lanceolate or subaristate, herbaceous finally brown or livid, gland-spurred teeth a little unequal, the dorsal one longest, 1.7–3 (3.2) mm long (0.4 mm longer to 1.3 mm shorter than tube), the ventral pair somewhat broader and shorter; *petals* bicolored, gland-tipped or not, the banner opening cream or pale yellow, early rubescent, sometimes gland-sprinkled, the epistemonous ones pink or pink-purple, often with pale outer edges, perched much below middle of androecium, 1.4–2.2 mm above hypanthium; *banner* 4.4–6.2 mm long, the claw (1.8) 2.3–3.3 mm, the deltate-cordate obtuse or emarginate hooded blade recurved through ± 40°, 2.6–3.5 mm long, 3.2–4.3 mm wide, recessed at base into a shallow cornet; *wings* 4.4–6.6 mm long, the claw 1.1–2.4 mm, the oblong-

elliptic blade 3.2–4.6 mm long, 1.6–2.4 mm wide; *keel* 5.5–7.2 mm long, the claws 1.8–3 (3.6) mm, the broadly oval-obovate blades 4–4.8 (5.3) mm long, 2.2–3.3 mm wide; *androecium* 10-merous, 5.5–7.5 mm long, the longer filaments free for 1.7–2.4 mm, the connective gland-tipped, the anthers 0.5–0.7 mm long; *pod* in profile obliquely obovate or semi-obovate, 2.1–2.8 mm long, the ventral suture slightly concave or slightly convex, the valves hyaline at base, papery distally, pilosulous from middle upward and sparsely gland-sprinkled; *seed* 1.6–2.2 mm long; $2n = 7_{II}$ (Mosquin). —Collections: 77 (xv).

Stony hills and plains, in open situations but entering diverse plant communities, from coastal savanna in Tamaulipas through deserts of the interior up to the arid grasslands of the Central Plateau, near sea-level in Tamaulipas and reaching 2250 m (7500 ft) in Zacatecas, strongly but not obligately calciphile, common on both slopes of Sierra Madre Oriental from s.-e. San Luis Potosí n.-w. through all the limestone ranges of Coahuila into trans-Pecos Texas (Val Verde, Brewster, Pecos cos.) and just into n.-e. Chihuahua (Sa. de los Pinos, mpo Guadalupe), w. over the Meseta to the headwaters of Río Nazas in n.-centr. Zacatecas, the n.-e. third of Durango, and just into s.-centr. Chihuahua (mpo Hidalgo del Parral); from San Luis Potosí extending s. in scattered localities at middle elevations along the s.-e. margin of the Meseta, apparently always on sedimentary formations, through n. Hidalgo (mpos Jacala, Metztitlán) and (?isolated) Querétaro (mpo Tequisquiapán) to s.-e. Puebla (near Puebla, and locally plentiful in the Tehuacán desert) into the highlands of n. Oaxaca (mpos Huajuapan de León, Teposcolula, Asunción Nochixtlán), there passing into *D. leucosericea*. —Flowering February to May, July to December, perhaps intermittently whenever conditions permit. —*Representative*: UNITED STATES. Texas: *Warnock 468* (TEX), *11,346* (WIS), *21,254* (TEX); *McVaugh 10,682* (ENCB, TEX); *Correll & Hanson 29,884* (RENNER). MEXICO. Chihuahua: *LeSueur 1510* (ARIZ, F, TEX); *Ripley & Barneby 13,910* (NY). Coahuila: *Johnston 8421* (GH, TEX), *8553, 8954* (GH); *Palmer 37* (F, NY, UC); *Purpus 4736* (F, UC). Nuevo León: *Warnock & Barkley 14,815M* (F, NY, WIS); *Barkley 16,034M* (GH, NY, TEX, US); *Ripley & Barneby 13,253* (CAS, NY). Tamaulipas: *Graham & Johnston 4383A* (TEX); *Stanford, Retherford & Northcraft 941* (ARIZ, NY); *Ripley & Barneby 14,753* (CAS, MEXU, NY, US). Durango: *Gentry 6897* (NY); *Ripley & Barneby 13,950* (NY). Zacatecas: *Gentry 8554* (UC); *Ripley & Barneby 13,474* (CAS, NY). San Luis Potosí: *Rzedowski 9567, 9627, 24,686* (ENCB); *Ripley & Barneby 13,304* (CAS, NY, MEXU, US), *14,773* (CAS, MICH, MEXU, NY, US). Querétaro: *Hernández 52* (ENCB). Hidalgo: *Troll 427* (M); *J. Vásquez* and *M. E. Moncayo in 1965* (ENCB). Puebla: *Arsène 1997* (NY); *Purpus 2649* (F, UC); *Rose & Hough 10,160* (NY, US). Oaxaca: *Mosquin et al. 6677* (NY); *Matuda 37,504* (MEXU); *Ripley & Barneby 13,642, 13,656, 14,584* (NY).

Dalea greggii (Josiah Gregg, 1806–1850) Gray, Mem. Amer. Acad. II, **5** (Pl. Thurb.): 314. 1854 ("*Greggii*"). — "(Dry hills, near Buena Vista, Coahuila, Dr. Gregg) Cerro Gordo, Coahuila; November; 1852." — Lectotypus (Gentry, 1950, p. 230), labelled "Near Buenavista, March 27/47, *Gregg*", GH! isotypus, NY! paratypi (*Thurber* from Cerro Gordo), GH. NY! — *Parosela greggii* (Gray) A. Heller, Catal. N. Amer. Pl. ed. 2, 6. 1900.

Parosela fulvosericea (brownish-silky, the hairs tarnishing when dried) Rydb., N. Amer. Fl. **24**: 89. 1920. — "Type collected in the region of San Luis Potosi, 1878, *Parry & Palmer 148*, in part..." — Holotypus, US # *24432* in part (mixed with *D. dorycnioides*), US! — *Dalea fulvosericea* (Rydb.) Gentry, Madroño **10**: 249. 1950.

A species of wide range and great altitudinal tolerance, consisting of several races that seem at present out of reach of taxonomic definition. Following Gentry (1950, p. 230, Pl. 15, fig. 1, map), I visualize *D. greggii* more easily in terms of the growing plant than of technical characters, each of those that at first seemed useful having proved fallible in practice. At the time of Gentry's revision *D. greggii* was best known from the high grasslands around the east and southwest periphery of the Chihuahuan Desert, but subsequent collecting has shown it to be equally common along the east piedmont of Sierra Madre Oriental, whence it strays off onto the coastal plain in Tamaulipas; and it is now known to follow the limestones of the Sierra Madre south as far as the highlands of northern Oaxaca. I am in full agreement with Gentry's segregation of the neatly allopatric and morphologically distinct *D. pulchra*, included by earlier workers in *D. greggii*, but I cannot now exclude from the latter the plant described as *D. fulvosericea*, discussed in more detail below.

On bare gravelly plains or hilltops and eroding bluffs in the northern and western segments of its range, at elevations above 1000 m, the average plant of *D. greggii* forms a mat of wiry, procumbently arching and interlacing stems that take root wherever they touch the ground, thereby forming masses up to 1–2 m diameter but only 1–2 dm high. The stem-pubescence associated with this growth-form is subappressed or ascending, the leaves are small and silvery, and the heads are mostly short, ovoid or conic, but the first of each major cauline axis nevertheless sometimes oblong (axis up to ± 2 cm; cf. *Correll & Johnston 19354* from trans-Pecos Texas, RENNER). Even on the plateau, however, plants seeding into protected gullies become taller, with high-arching stems less prone to root, and ampler cauline leaves. This tendency to luxuriance becomes exaggerated under moister, warmer conditions encountered along the east piedmont of Sierra Madre, where the stems are still potentially tip-rooting but form thickets up to 3–5 dm tall and the spikes become more often oblong (axis up to 5.5 cm; cf. *Runyon 889* from Tamaulipas); and the same region yields occasional glabrescent populations with greenish foliage and only thinly pubescent calyces (*Graham & M. Johnston 4666A*, MEXU, TEX). With added stature, but inconsistently, the pubescence of stem and leaf, or of stem only, while no thinner becomes looser and less glossy. In southeast San Luis Potosí and adjoining Hidalgo and Querétaro this type of vesture, accompanying spikes either short or long for the species, becomes shaggy-villous, and the stems are perhaps (herbarium specimens are enigmatic in this context) largely ascending, not radicant. The typus of *Parosela fulvosericea*, placed by Rydberg (1920) not near *P. greggii* but among his *Tuberculatae*, represents this more loosely villosulous and more fruticose phase, which appears, nevertheless, to be connected with typical *D. greggii* by intermediate forms.

No populations of *D. greggii* are known from between northern Hidalgo and southern Puebla; but the species becomes again common in the Tehuacán desert, here assuming a form as prostrate and readily rooting as that of the Meseta Central, and continues south into arid mountains of northern Oaxaca, where it passes imperceptibly into *D. leucosericea*.

A remarkable plant, diffidently interpreted (ad interim) as a coarsely leafy form of *D. greggii*, has been collected out on the Gulf coast of Tamaulipas, close to sea-level (Altamira road, Tampico, *Kenoyer 801a*, F). The material examined, not of first quality, suggests a distinct entity, notable for its large bracts (to 7 mm), large calyx (tube 3–3.2 mm, teeth 2.9–3.2 mm) with many (6–10) small scattered glands in each intercostal panel of the tube.

While *D. greggii* is believed to be closely allied, through *D. sericea*, to typical members of ser. *Psoraleoides*, its stems are sometimes moderately warty, and it is then with difficulty excluded from ser. *Tuberculatae*, among which, as we have seen, Rydberg aligned one form. It is more readily excluded from ser. *Versicolores*, where Rydberg placed the typical phase, by a combination of few, normally silky leaflets and internally pubescent bracts. With the aim of covering all eventualities, I have endeavored to key *D. greggii* into all three series.

IVC (xvi). Series TUBERCULATAE (Rydberg) Barneby

Fruticose or at least suffrutescent when adult, some low, diffuse and adventitiously radicant, but *D. choanosema* apparently a tall herb and *D. bicolor* varying from subherbaceous to high-fruticose or arborescent; *stems* of the year prominently verruculose, especially under the heads; *leaflets* of primary cauline leaves mostly 2–8 (in *D. bicolor* to 10) pairs, these always small, in the majority 1–7 mm, rarely up to 8 (a few to 12) mm long; *spikes* varying from globose and conelike to loose and obviously spiciform; *bracts* either persistent or deciduous; *calyx* pilose or pilosulous externally, the intercostal panels of the tube charged with 1 (the ventral ones sometimes with 2) rows of glands, the deltate to triangular-subulate teeth commonly all shorter than tube, but the dorsal tooth sometimes longer; *flowers* usually bicolored, the banner opening white or yellowish, sometimes purple-edged, the pale parts rubescent in age, the epistemonous petals perched well below middle of androecium (mostly 1–2.5, rarely to 3 mm above hypanthium rim), in most species rose-purple or pink, rarely vivid blue (some forms of *D. bicolor*) or dull plum-purple (*D. gypsophila*), in *D. capitata* all petals opening yellow fading orange or brownish, the whole flower variable in size, the blades of keel (detached, always longer than banner) 3.5–7 mm long. — Spp. 13, several highly localized and some of these poorly known, the widely dispersed members polymorphic and especially variable in habit, stature, and pubescence, in some form ubiquitous over the Central Plateau of Mexico, 1 n. to w. Texas and s.-w. New Mexico, 3 s. to Oaxaca, 1 to Sierra Madre del Sur in Guerrero, poorly represented by 1 form in middle Transverse Volcanic belt, apparently absent from Balsas Depression, 1 on the Pacific slope in s. Arizona and Sonora, 3 in Baja California.

Dalea subgen. **Parosela** sect. **Parosela** ser. **Tuberculatae** (Rydberg) Barneby, comb. nov., based on *Parosela* subgen. *Euparosela* XXII. *Tuberculatae* Rydb., N. Amer. Fl. **24**: 86. 1920. — Sp. lectotypica: *P. tuberculata* (Lag.) Rose = (syn. tax.) **Dalea bicolor** Humb. & Bonpl. ex Willd.

Parosela subgen. *Euparosela* XVIII. *Capitatae* Rydberg, N. Amer. Fl. **24**: 83. 1920. — Sp. lectotypica: *P. capitata* (Wats.) Rose = **Dalea capitata** Wats.

A series that presents many unsolved taxonomic problems, all sorts of which are encountered in the protean *D. bicolor* sens. lat., a concept equivalent to half the species of *Tuberculatae* recognized by Rydberg (1920, pp. 86–90). The comprehensive *D. bicolor* as defined herein is an aggregate of small geographic races, all inherently variable in stature, pubescence, and fine detail of leaflet-number and flower-size and becomes, with the exception of the similarly constituted *D. versicolor*, the mostly widely dispersed dalea of the *Parosela* type. It served as the nucleus around which the concept of ser. *Tuberculatae* took its original form and still remains central to its group, representative of a xerophytic kind of more or less shrubby dalea with warty stems and relatively short-toothed calyx that is dominant over the subdesertic zone and high arid grasslands of the Mexican Plateau and in the desert mountains of Baja California. Except for *D. pulchra* in Sonora, the *Tuberculatae* are almost lacking in Sierra Madre Occidental above the level of grasslands, quite so from its Pacific slope, and are unrepresented in the Balsas Depression and most of Sierra Madre del Sur, where their place is taken by members of the closely related ser. *Versicolores* and *Psoraleoides*.

Discovery of several species unknown to Rydberg has introduced into ser. *Tuberculatae* so great a fund of morphological variation that a definition of the series that will exclude all alien elements is no longer possible. Ideally ser. *Tuberculatae* differs from ser. *Psoraleoides*, which has the same calyx, in the prominence of the cauline warts, raised above the surface as little hemispherical domes or even as laterally attached grains, com-

bined with small and carnosulous leaflets. But *D. greggii*, indissolubly attached to ser. *Psoraleoides* by way of *D. leucosericea*, which lies comfortably beyond the orbit of *Tuberculatae*, may have either smooth or moderately warty stems and leaflets highly variable in size and texture. Forms of *D. greggii* can be accomodated without difficulty in either series, and for convenience the species has been keyed under both headings. From ser. *Versicolores* the *Tuberculatae* differ ideally in the short-toothed calyx and heavily warty stems already mentioned combined with relatively few leaflets, mostly 2–8 pairs in primary cauline leaves, but these rising to 10 pairs in some forms of *D. bicolor*, and only in combination with decisively short calyx-teeth. An easy passage from one series to the next is established by way of *D. wigginsii* and *D. radicans*, species with short-toothed calyces superficially similar in habit but seemingly allied each to a sympatric member of ser. *Versicolores* with long, plumose teeth, and more like *Versicolores* than any typical *Tuberculatae* in their relatively many leaflets and scarcely verruculose stems.

Enlargement of ser. *Tuberculatae* since Rydberg's monograph is due almost wholly to new discoveries. I also include here, however, the small group *Capitatae* Rydb., different only in color of the petals, which are uniformly yellow on opening. Single species or in the case of *D. cylindrica* one variety of a species different from their pink-, purple-, or blue-flowered kindred are now known in ser. *Frutescentes, Coeruleae*, and *Versicolores* and there seems no urgent need for segregation of yellow-flowered entities unless the color, as in ser. *Galbinae* for example, has accompanied some other major morphological advance.

Key to the Species of Ser. *Tuberculatae*

1. Plants of Continental Mexico and s.-w. United States (w. Texas to s. Arizona).
   2. Petals bicolored, the banner opening white or yellow (early rubescent), the epistemonous petals pink or purple, rarely vivid blue.
      3. Stems and primary cauline leaves glabrous, but these sometimes subtending densely pubescent axillary short-shoots; *leaflets* of primary leaves 4–8 pairs.
         4. Leaflets densely microscopically papillate beneath; *spikes* loose; *epistemonous petals* dull plum-purple; *pubescent axillary short-shoots* 0; dwarf radicant subshrubs, obligate gypsophytes of intermontane valleys in Sierra Madre Oriental in s.-centr. Nuevo León.
            116. *D. gypsophila* (p. 442)
         4. Leaflets (except for glands) smooth beneath; *spikes* dense; *epistemonous petals* rose-purple; *pubescent axillary short-shoots* present (sometimes at anthesis represented by minute tomentulose buds); range different.
            5. Interfloral bracts persistent through anthesis; *calyx-tube* densely silky-pilose (hairs to 0.45–0.65 mm long); *stems* many, erect and ascending from a common trunk to form rounded bushes; high grasslands of Mexican Plateau in s. Zacatecas and w. San Luis Potosí.
               114. *D. hemsleyana* (p. 438)
            5. Interfloral bracts deciduous; *calyx-tube* thinly pilosulous (hairs ± 0.35 mm); *stems* diffuse or prostrate; range unknown.
               113. *D. macrotropis* (p. 437)
      3. Stems or foliage, usually both, always at least the lower face of leaflets, pilosulous, tomentulose, or puberulent, or if the plant glabrous to the spikes then leaflets only 2–4 pairs.

6. Spikes (dense, conelike, subglobose) when young subtended by a 2–3-seriate involucre of ventrally glabrous, dorsally tomentulose bracts, these either empty or subtending rudimentary flower-buds; *leaflets* of primary leaves 2–4, of branchlets mostly 1–2 (3) pairs, ± sericeous; s. Arizona and Sonora, confined to the Pacific slope.
105. *D. pulchra* (p. 415)

6. Spikes (either loose or conelike) not involucrate, the lowest bracts, if persistent, each subtending a developed flower; widespread over Mexican Plateau, s. to Oaxaca, n. to New Mexico and Texas, absent from the Pacific slope. 115. *D. minutifolia* (p. 440)

7. Interfloral bracts glabrous within, deciduous by full anthesis; *leaflets* 2–4 pairs, only 1–3 mm long, glabrous or minutely puberulent, carnose; *spikes* loosely few-flowered; valley of México to s. San Luis Potosí, n. Puebla, and adjacent Veracruz.

7. Interfloral bracts usually pubescent inside, densely so if early deciduous, if glabrous inside the leaflets more numerous, or larger, or densely pilose-tomentulose, and range different.

8. Spikes loose, the calyces not concealing the whole axis.

9. Species local in Sierra Madre del Sur in Guerrero; *stems* both erect and herbaceous, ± 1 m tall; *blade of banner* gland-sprinkled. 109. *D. choanosema* (p. 431)

9. Species of extensive range but unknown from Sierra Madre del Sur; *stems* fruticose or early becoming so, sometimes arborescent, if woody only at base then less than 5 dm tall, appearing herbaceous only in juvenile states or far n.-ward in n.-e. Mexico and adjacent United States; *blade of banner* sometimes gland-tipped but not -sprinkled.
108. *D. bicolor* (p. 421)

8. Spikes dense, the calyces contiguous and concealing the axis.

10. Leaflets 4–7 pairs, greenish, pilosulous only beneath, glabrous above; small diffuse herbs with radicant stems up to 2.5 dm long; local in Edo. de México and Hidalgo.
112. *D. aenigma* (p. 435)

10. Leaflets 2–4, rarely 5 pairs, but only 2–4 pairs if the plant either diffuse or radicant, and the leaflets themselves then almost always silky both sides.

11. Prostrate or diffuse, often tip-rooting or irregularly radicant shrublets forming mats or low thickets; cf. *D.* (ser. *Psoraleoides*) *greggii* (p. 409).

11. Shrubs and shrublets of rounded, bushy outline, the stems all arising from a single trunk or caudex.

12. Bracts persistent, obovate-flabellate in outline, stiffly papery and firm; *spikes* (except some few central to major divisions of the inflorescence) subglobosely capitate, their axis 2–12 (20) mm long; *calciphile*, widespread over w. edge of Meseta Central, n.-w. to Durango, s. interruptedly to centr. Oaxaca. 106. *D. dorycnioides* (p. 417)

12. Bracts deciduous, narrowly ovate, thin-textured; *spikes* ovoid-oblong, the axis mostly 2–3 (4) cm long; *calcifuge* and local in s.-e. Puebla and adjacent Oaxaca. 107. *D. piptostegia* (p. 419)

2. Petals all pale yellow, ageing pinkish-brown, reddish, or orange. Small shrubs of arid Meseta Central and Sierra Madre Oriental, calci- and gypsophile.
117. *D. capitata* (p. 444)

1. Plants of Baja California (Norte and Sur).
13. Stems and foliage at least thinly pubescent, often densely tomentulose-pilosulous, but if the leaflets green, always at least thinly pilosulous dorsally; *banner* glandless; Sierra de la Giganta n. to Sierra San Pedro Mártir.
108e. *D. bicolor* var. *orcuttiana* (p. 429)

13. Stems and foliage glabrous; *banner* gland-sprinkled in eye of blade; either along the Pacific coast around Bahía Magdalena and vicinity or on the Cape mountains.
14. Spikes moderately dense, not conelike; *leaflets* emarginate; coastal desert around Bahía Magdalena and vicinity, below 50 m.
110. *D. brandegei* (p. 432)

14. Spikes very dense, hard and conelike; *leaflets* obtuse (bluntly gland-mucronulate); mountains of Cape region, at ± 1470–1800.
111. *D. trochilina* (p. 434)

105. DALEA PULCHRA Gentry
(Plate XCVII)

Low, stiffly branched shrubs of bushy outline, sometimes flowering precociously as suffrutescent herbs, becoming 5–10 dm tall, the slender, virgate young branches striate, prominently verruculose, and silky-pilosulous with subappressed hairs, the old stems brown or gray, glabrate, fissured, the small, distant leaves silvery-pilosulous or subtomentulose, the leaflets equally pubescent both sides or more densely so above, charged beneath with ± prominent reddish glands; *leaf-spurs* 0.3–0.8 mm long; *stipules* triangular-subulate, 0.8–1.5 mm long, firmly chartaceous, livid, puberulent; *intrapetiolular glands* 0 or minute; *post-petiolular glands* prominent, obtuse; *main cauline leaves* (rarely present at anthesis) up to 1.5 cm long, often shorter than the internodes, shortly petioled, with narrowly margined, punctate rachis and mostly 2–3 (4) pairs of obovate to oblanceolate, obtuse or emarginate, bluntly gland-mucronulate, mostly folded leaflets 1.5–5 mm long, the leaves of branchlets similar but smaller, with only 1–2 (3) pairs of leaflets; *spikes* terminal to main and secondary branchlets (then loosely paniculate) or to axillary, inhibited or subobsolete branchlets (then often forming a narrow spikelike inflorescence of heads), all densely capitate, subglobose or broadly ovate-oblong, without petals 11.5–16 mm diam, the densely pilosulous axis 4–17 mm long; *bracts* heteromorphic, all deciduous (but sometimes held fast between the crowded calyces) 2–6.5 mm long, the outermost 2–3 ranks imbricated in ascending series, subtending only rudimentary buds, thus forming an involucre of ovate externally velvety-canescent scales, the inner ones linear-lanceolate or -elliptic, longer than the outer ones, pilose externally, all chartaceous, eglandular, glabrous within; *calyx* (4.5) 4.8–7.2 mm long, densely pilose with spreading-ascending, spiral hairs up to 1.1–2 (2.2) mm long, the tube 2.4–3.2 mm long, deeply recessed behind the banner and the orifice thus oblique, the ribs brown, slender but becoming prominent, the membranous intervals charged with one row of minute (sometimes obsolete), transparent glands, the triangular-aristate, spurred teeth ± unequal, the dorsal one longest, 2–4.2 mm long (0.5 mm shorter to 1.2 mm longer than tube), the ventral pair shortest but hardly broader than the rest, all stellately spreading in age; *petals* opening bicolored, the banner at first cream-colored, early rubescent, the inner ones pink-purple, elevated 1.2–1.8 mm above the hypanthium rim, the keel sometimes

charged with a minute subapical gland but all usually glandless; *banner* 6–7.5 mm long, the claw 3–4.3 mm, the ovate- or deltate-cordate blade recurved through ± 40°, 2.8–4.2 mm long, 3.4–4.4 mm wide, entire or emarginate at apex, open at base; *wings* 6–8 mm long, the claw 2–3 mm, the elliptic-oblong blade 4.1–5 mm long, 2–2.6 mm wide; *keel* 7.8–10.2 mm long, the claws 3–4 mm, the broadly elliptic-obovate blades 5.2–6.8 mm long, 3–3.5 mm wide; *androecium* 7.5–9 mm long, the longest filament free for 1.8–2.8 mm, the whitish, gland-tipped anthers 0.6–0.7 mm long; *pod* (seldom seen) ± 2.5 mm long, obliquely obovoid, the style-base terminal but excentric, the valves glabrous and hyaline in the lower half, papery distally, charged along the top with a dense crest of ascending hairs; n = 7 (Spellenberg, 1972, 1973). — Collections: 25 (o).

Grama grasslands, within the lower edge of the oak-belt and below it, along the w. edge of the Sonoran Desert, 900–1350 m (± 3000–4500 ft), forming colonies but local, southern Arizona on the Catalina, Rincon, and Baboquivari mountains, Pima County; near Superior, Pinal County; s. through Santa Cruz and adjoining Cochise County to the forks of Rio Sonora near Cucurpe and Arizpe, Sonora; apparently isolated on Rio Cedros (n. of Tesopaco, at 480 m) in s. Sonora. — Flowering March to May. — *Representative*: UNITED STATES. ARIZONA. Pinal: *Meebold 15,273* (M); Pima: *A. Nelson 11,126a* (NY, UC), *Rose 11,812* (NY, US), *Brass 14,242* (NY); Santa Cruz: *Peebles & Fulton 11,550* (NY, US), *Gentry 3530* (ARIZ, UC); Cochise: *Atwood 2183* (NY). MEXICO. SONORA: *R. & M. Spellenberg 3046, 3049, 3052* (NY), *Gentry 3045* (ARIZ, F, MEXU, UC).

Dalea pulchra Gentry, Madroño **10**: 227, Pl. 14, fig. 1 (map). 1950. — "Type. Soldiers Trail Canyon, near Mount Lemmon road, southern slopes of the Santa Catalina Mountains, Pima County, Arizona, about 4500 feet elevation, April 15, 1946, *F. W. Gould and G. T. Robbins* 3534..." — Holotypus, ARIZ! isotypus, UC!

The aptly named *D. pulchra* was collected first by the botanists of the Boundary Survey, by Arthur Schott on Sierra de Pajarito, the present Sierra Peña Blanca (± 15 km w. of Nogales, Santa Cruz Co., Arizona), and by Parry at Agua Prieta, across the present international line from Douglas, Arizona. The specimens were misidentified by Torrey as *D. greggii*, but as Gentry pointed out in the protologue of *D. pulchra*, the available material of the two species was at the time insuffient to reveal the true character of either. Features common to *D. pulchra* and *D. greggii* as it occurs on the Mexican Plateau are small, silvery-pilose main cauline leaves composed of only 2–4 pairs of leaflets, and short spikes of roseate flowers. In habit they are entirely different. Adult plants of *D. pulchra* form stiffly branched bushes of round outline 5–10 dm in diameter, the one to several stems arising all from one root; whereas *D. greggii* has flexuously arching stems that root where they touch the ground and grow together into a low tangled thicket rarely over 3 dm tall but eventually many times as wide. The spike of *D. pulchra* is very dense, subglobose, and without petals 12–16 mm diameter; the petals are relatively large, the keel-blades mostly 5–7 mm long; and the bracts are pilose externally but glabrous within. By contrast the spike of *D. greggii*, though short, is not conelike, without petals only 8–11 mm diameter; the petals are smaller, commonly less highly colored, with keel-blade mostly 4–5 mm long; and the bracts are internally silky. Flowering specimens of *D. greggii* have been collected in nearly every month of the year, but the main bloom occurs between July and December. I have seen no flowering specimens of *D. pulchra* collected in late summer or fall, and the main bloom is certainly vernal, between March and May. An unusual feature of *D. pulchra* is the involucre of velvety-pubescent bracts imbricated in about three cycles at the base of the flower spike. These outer bracts are broader and shorter than the inner ones and subtend rudimentary flowers. Finally, as shown by Gentry's map (1950), the

ranges of the two species are notably different, *D. pulchra* being found only on the Pacific slope of the northern Sierra Madre whereas *D. greggii* ranges from the eastern piedmont of the Sierra across the Chihuahuan Desert into western Texas and far south and east to Tamaulipas and Oaxaca.

Like several related members of ser. *Tuberculatae, D. pulchra* presents two aspects at anthesis, one drought-inhibited. Most of the material examined is of this sort, reflecting the commonly dry conditions prevailing during the spring of most years over the range of the species. Here the spikes are mostly borne on brachyblasts issuing from the axils of already fallen primary leaves and in consequence the composite inflorescence forms a sort of virgate raceme of heads, as shown in Plate XCVII. Following the exceptional rains of the winter 1972–3 a series of profusely flowering specimens (cited above) was collected in mid-April by R. and M. Spellenberg on an upper fork of Río Sonora between Magdalena and Cucurpe. In these plants the lateral branchlets have elongated and a fair number of primary cauline leaves persist well into anthesis. As a result, each main division of the flowering branch is loosely and openly paniculate and the foliage, while still small and sparse in relation to size of the flower-heads, is comparatively ample. The general aspect of these luxuriant examples of *D. pulchra* recalls *D. dorycnioides*, a distantly allopatric ally technically separable by the internally silky floral bracts and moreover another species of which the main flowering season begins following summer rains and extends long into the winter.

106. DALEA DORYCNIOIDES DeCandolle
(Plate XCVIII)

Small, twiggily branching, polypodial shrubs of bushy outline, at anthesis (1.5) 3–10 (12) dm tall, with smooth or furrowed, brown bark and densely, grossly verruculose young branches, the growth of the year ± densely silky- or velvety-pilosulous or -tomentulose with fine spreading-ascending hairs up to 0.1–0.4 mm long, the stems sometimes glabrescent, castaneous or livid, the foliage as a rule gray or silvery, the leaflets mostly pubescent both sides, sometimes glabrescent or even glabrous above, then greenish, exceptionally green both sides but always bearing some rudiments of vesture, and the young spurs always densely pubescent, the leaflets punctate on both sides, but the dots commonly concealed by vesture; *leaf-spurs* 0.3–1.1 mm long; *stipules* triangular or subulate, livid or castaneous, puberulent or glabrate, 0.6–2 mm long; *intrapetiolular glands* minute, impressed, often concealed by vesture; *postpetiolular glands* conic or mammiform, prominent, orange or transparent, glabrous or puberulent; *main cauline leaves* (3) 4–16 (24) mm long, short-petioled or subsessile, with narrowly margined, often punctate rachis and 2–4 pairs of obovate or obovate-cuneate to broadly oblanceolate, truncate-emarginate or retuse, usually folded, subsessile or shortly petiolulate leaflets (1) 2–7.5 (12) mm long; *peduncles* terminal to all the branchlets (the first one of each main branch leaf-opposed), 0–3.5 (7) cm long; *spikes* very dense, conelike, conic-ovoid or depressed-hemispherical becoming subglobose or shortly oblong, without petals or androecia 7–9.5 mm diam, the villosulous axis 2–12 (20, exceptionally a few up to 30) mm long; *bracts* persistent, broadly rhombic-obdeltate, -obovate, or flabellate, abruptly short-acuminate or truncate and mucronate, shallowly concave, (1) 1.5–2.5 mm long, the outermost sometimes shorter than the rest, all pilosulous and tuberculate dorsally or glabrescent and castaneous in the distal third, except at very tip silky within; *calyx* (3.4) 3.8–5.3 mm long, densely silky-pilosulous with spreading-ascending or subappressed hairs up to ± 0.2–0.6 mm

long, the ovoid, often oblique tube 2.2–3.4 mm long, recessed behind the banner, the ribs slender, immersed or scarcely prominent in age, the rather firm but pale intervals charged with one row of usually 3–4 very small, transparent glands visible only from within, the triangular-subulate, reddish or livid, gland-spurred, internally pilosulous, finally connivent teeth unequal, the dorsal one longest, 1.2–2 mm long, obviously shorter than the tube, the ventral pair similar but shorter; *petals* bicolored, the banner at early anthesis cream-yellow or almost white except for a green eye in the blade, rubescent in age, the inner petals vivid rose-purple or rarely violet-purple, elevated 1.2–2.5 mm above hypanthium rim, all glandless, or either keel or banner or both charged at apex with a small blister-gland; *banner* 4.5–6.7 mm long, the claw 2.1–3.4 mm long, the little recurved, ovate-deltate, emarginate, hooded blade closed at base into a deep cornet, (2.3) 2.9–4 mm long, 2.8–4.2 mm wide; *wings* 5–7.1 mm long, the claw 1.4–2.5 mm, the broadly oval or lance-oblong blade 3.6–5.7 mm long, 1.3–3 mm wide; *keel* 6.6–9.2 mm long, the claws 2.3–4.3 mm, the blades 4.3–6.4 mm long, 2.5–4.4 mm wide; *androecium* 10-merous, 7.5–9.5 mm long, the longest filament free for ± 2.3–3 mm, the yellowish anthers 0.6–0.8 mm long; n = 7_{II} (Spellenberg, 1973). — Collections: 30 (viii).

Dry open brushy and rocky hillsides, stony washes, sometimes abundant on gullied badlands, 1230–2400 m (4100–8000 ft), often forming extensive colonies, in Larrea desert, cactus-thorn-forest, pine-pinyon woodland, or (s.-ward) ascending into pine-oak forest, strongly (perhaps obligately) calciphile, widespread along the w. slope and dry intermontane valleys of Sierra Madre Oriental from s.-centr. Nuevo León (Galeana district) to Hidalgo and perhaps extreme n. México, w. to the margin of Mapimí basin in the extreme s.-e. angle of Chihuahua and the lower basin of Río Nazas in n.-e. Durango; apparently isolated in n.-centr. Oaxaca. — Flowering (August) September–December. — *Representative*: CHIHUAHUA: *Chiang et al. 9040* (NY). DURANGO: *Spellenberg & Dunford 2934* (NY); *Gentry 6890* (F, NY); *Ripley & Barneby 13,590* (CAS, GH, K, MICH, MEXU, NY, US), *14,208* (CAS, NY). NUEVO LEÓN: *Ripley & Barneby 13,793* (NY). TAMAULIPAS: *Gentry 6750* (ARIZ, UC, US); *Stanford, Wetherford & Northcraft 880a* (ARIZ, NY). SAN LUIS POTOSÍ: *Parry & Palmer 148* (BR, NY, US in part); *Ripley & Barneby 13,774* (CAS, MEXU, NY, US), *14,763* (CAS, NY, US). HIDALGO: *Pringle 8722* (F, M, MEXU, NY, UC, US, W); *Purpus 478* (UC). OAXACA: *E. W. Nelson 1916* (NY); *Ripley & Barneby 13,670* (CAS, GH, K, MEXU, MICH, NY, US).

Dalea dorycnioides (resembling some sp. of *Dorycnium* L.) DC., Prod. **2**: 245. 1825. — "...in America calid...(v.s.)" — Holotypus, "ex herb. Thibaud.", G-DC! — *Parosela dorycnioides* (DC.) Rydb., N. Amer. Fl. **24**: 90. 1920 ("*dorycnoides*").

Dalea pulchella (pretty) Moric., Pl. Nouv. Amér. 9, Tab. VII. 1836. — "Hab. circa St. Louis de Potosi." — Lectotypus, *Berlandier 2202*, collected in November, 1830, G! isotypus, NY! — *Parosela pulchella* (Moric.) A. Heller, Cat. N. Amer. Pl., Ed 2: 6. 1900. — Non *Dalea pulchella* G. Don (1832).

Dalea decora (handsome) Schauer, Linnaea **20**: 743. 1847. — "In Mexici provincia Oaxacana. *Aschb.* [= Aschenborn] *n.* 255 *et* 270." — Typus formerly at B, destroyed in 1943. The ample and detailed description identifies it. — *Parosela decora* (Schauer) Rydb., N. Amer. Fl. **24**: 90. 1920.

The characters to which *D. dorycnioides* owes its distinct facies and specific status apart from the polymorphic *D. bicolor* are the dense, knoblike flower-spikes, ideally depressed-hemispherical to shortly oblong-ovoid, and the broad, short bracts that persist between the calyces until, with ripening of the seed, the inflorescence starts to fall apart. The foliage varies in amplitude and pubescence in ways that can be matched, step for step,

in *D. bicolor*, and there seems to be no way of telling the two species apart until the spikes have taken form. From one end of the species' range to the other, but especially under conditions approximating desert, the foliage is permanently gray or when young silvery with a close, plushlike indumentum of extremely fine and short hairs; and the leaflets tend to be small (2–6 mm long), crowded on the rachis, and borne on petiolules immersed in the vesture so that they appear nearly sessile. But even in desert, as about Yerbaniz in northeastern Durango, the upper leaf-surface is sometimes green and glabrous. The two known collections from Oaxaca have exceptionally small leaves combined with low stature and small flowers, and one of them (*E. W. Nelson 1916*, NY) seems to have provided the key characters ascribed to *Parosela decora* in Rydberg's monograph. Discounting, for the moment, the chance that I am misapplying the name *D. decora*, of which the type is lost, I feel sure that the Oaxacan plant that has been associated with the latter name represents a mere form of *D. dorycnioides*, The closest match for the Oaxacan type occurs, rather unexpectedly, at the northern limit of the species in Nuevo León (Galeana district).

In northern Hidalgo, under relatively mesic conditions of oak-pine forest, but still on limestone, *D. dorycnioides* is represented by a form with ample primary cauline leaves. The leaflets here are green, large (to 12 mm long), visibly petiolulate, glabrous or nearly so above and only thinly pilosulous beneath. However these green leaves subtend leaf-spurs or buds as densely tomentulose as those of the whiter, desert phase. The typus of *D. dorycnioides* represents the greener phase, which is often further distinguished by relatively long-pedunculate heads; that of *D. pulchella* Moric. (non G. Don) the gray-tomentulose, xeromorphic one with mostly sessile or subsessile spikes.

While I have emphasized the diagnostic importance of the short spike, the close observer will find here and there, even in seemingly uniform populations of normal and typical *D. dorycnioides*, some individual plants in which the flower-head that terminates each main division of the panicle (and therefore appears leaf-opposed) is, in reality, more or less elongate, and such spikes (e.g. *Shreve 9340*, ARIZ, with axis up to 3 cm long) isolated from their context suggest direct passage into *D. bicolor*. Near Zimapán, Hidalgo, where *D. dorycnioides* is dominant over hundreds of acres of barren, eroded, limestone hills, I found it directly associated with a form of var. *bicolor*, but even though occasional long spikes were found in *dorycnioides*-like plants there was no convincing evidence that introgression was taking place between the two species, at least on any significant scale.

I have seen one old specimen attributed to W. F. Keerl (BR, dated 1829) that is labelled Tlalpujahua, i. e. the gold-mining community near El Oro on the Michoacán-México state line northwest of Toluca. This locality is situated in the Neovolcanic belt, where *D. dorycnioides* is not to be expected, and the record requires confirmation. The seeds from which the typus of *Dalea versicolor* Zucc. were raised in Munich were also said to have been collected by Keerl at Tlalpujahua, although the species has not since been seen north of central Oaxaca. The data are thus doubly suspect.

The epithets *decora* and *pulchella* which have been applied to forms of *D. dorycnioides* are well deserved, for there are few handsomer small shrubs. The neat bushy habit and gray foliage are attractive throughout the year, and the long succession of proportionately large vivid flowers, coming as they do at a season when there are few competitors for attention, entitle the species to garden trial in Mediterranean climates.

107. Dalea piptostegia Barneby
(Plate XCVIII)

Low, leafy, abundantly floriferous shrubs of rounded outline, in aspect resembling *D. dorycnioides*, up to 7 dm tall and as wide or wider, with many repeatedly branching, castaneous or purplish (when old, brown and furrowed), densely verruculose stems,

variable in pubescence, either densely pilosulous-tomentulose with extremely fine, spreading and ascending hairs up to 0.1–0.2 mm long, the herbage then gray and the leaflets subequally pubescent both sides, or the vesture reduced to an inconspicuous remnant, the stems then glabrous or nearly so and the foliage green, the leaflets (always punctate beneath) glabrous above, puberulent dorsally; *leaf-spurs* 0.5–0.9 mm long; *stipules* lance-subulate, 1–2.4 mm long, papery or becoming so, reddish; *intrapetiolular glands* small, subimmersed; *post-petiolular glands* prominent, puberulent; *leaves* very shortly petioled, the main cauline ones (readily deciduous) 1.5–2.5 cm long, with 3–4 (5) pairs of oblong-oblanceolate, emarginate, flat or loosely folded leaflets 4–8 mm long, the terminal one sessile or almost so, the leaves of short-shoots present in almost all primary axils shorter, with 2–4 pairs of smaller leaflets; *peduncles* at first leaf-opposed and 2–5.5 (7) cm long, the later ones terminal to branchlets and 0.5–2.5 cm long, all prominently verruculose; *spikes* moderately dense, at first ovoid, becoming oblong in outline, the flowers (pressed) falling in 3–4 ranks but concealing the densely pilosulous axis, this finally in primary spikes 2–3 (4) cm long, in later spikes shorter; *bracts* (except sometimes the lowest of each spike) readily deciduous by full anthesis, ovate-apiculate or short-acuminate, 2–3.5 mm long, flat to shallowly navicular but not embracing calyx, papery, inconspicuously glandular, pilosulous to densely tomentulose dorsally, thinly to densely pilosulous within; *calyx* 4.2–5.5 mm long, pilosulous (often densely) with fine spreading spiral hairs up to 0.5–0.8 mm long, the tube 2.2–2.6 mm long, its orifice slightly oblique but deeply recessed behind banner, the slender, castaneous ribs becoming prominent, the membranous intervals charged with 1 row of 3–4 small transparent or golden glands, the triangular-acuminate, livid, gland-spurred and -tipped teeth a little unequal, the dorsal one 2–2.9 mm long (0.3 mm shorter to 0.4 mm longer than tube), the rest a little shorter and broader; *petals* bicolored, the banner opening yellowish (sometimes pink-edged), rubescent in age, the epistemonous ones rose-purple, perched 0.9–1.7 mm above hypanthium rim, all (or all but wings) charged with a small subapical gland; *banner* 6.5–7.5 mm long, the claw 3–3.6 mm, the suborbicular, emarginate blade scarcely cordate at base, recessed at claw into a shallow cornet, 3.3–4.5 mm long, 4.4–5 mm wide; *wings* 6.3–7.3 mm long, the claw 2.1–2.5 mm, the oblong-elliptic blade 4.4–5.4 mm long, 2.1–2.8 mm wide; *keel* 8.5–9.6 mm long, the claws 3.2–3.7 mm, the obliquely ovate-elliptic blades 5.1–6.6 mm long, 3.1–4.1 mm wide; *androecium* 8–9 mm long, the filaments free for 2.6–3 mm, the connective gland-tipped, the anthers 0.55–0.7 mm long; *pod* not seen. — Collections: 2 (i).

Rocky ledges and open brushy slopes in the oak-belt, on andesitic bedrock, ± 1830–2400 m (6100–8000 ft), known only from Sierra Madre Occidental in extreme n. Oaxaca and adjoining Puebla. — *Material*: PUEBLA: Coxcatlán, mountains, 7–8000 ft, sept. 1909, *Purpus 4147* (F, UC). OAXACA: cf. typus.

Dalea piptostegia (with deciduous bracts) Barneby, sp. nov., *D. dorycnioidem* certe affinem adspectu simulans sed bracteis ovatis (nec flabellatis) ab alabastro deciduis, spicisque florum minus densis oblongis nec capitato-globosis abstans. — Fruticulus ramosissimus ad 7 dm usque altus subaequilatus nunc undique molliter tomentulosus griseus, nunc glabrescens (foliis tunc viridibus); foliola plerumque 3–7-juga oblongo-obovata emarginata 4–8 mm longa; spicae axis 2–3 (4) cm longus, dense multiflorus, floribus contiguis; bracteae interflorales ovatae subacuminatae 2–3.5 mm longae, utrinque pubescentes; calycis pilosuli tubus post vexillum recessus 2.2–2.6 mm longus, dentes inter se subaequilongi triangulari-acuminati ± 2–2.9 mm longi; vexillum luteolum nunc roseo-marginatum mox rubescens, lamina suborbiculari ± 4.5–5 mm lata; *petala* epistemonea

± 1–1.7 supra hypanthium inserta, carinae ut alarum laminis roseo-purpureis ejus ± 5–6.5 mm longis. — OAXACA: sunny open slopes and rock-ledges in the oak-belt, on andesite, 6100 ft (± 1830 m), mountains e. of Teotitlán del Camino on road to Huautla de Jiménez, near crest of Sierra Madre, nov 18, 1966, *Ripley & Barneby 14,726*. — Holotypus, NY; isotypi, CAS, F, GH, US.

The type-population of *D. piptostegia* was mistaken in the field for some form of *D. dorycnioides*, although the spikes were altogether too long and lax to be typical and the habitat was out of harmony with what is known of the ecology of the latter species. Subsequent study revealed further differences in the spikes. That of *D. dorycnioides* is always conelike, usually squatly capitate, and the firmly papery, obovate-flabellate interfloral bracts persist under the calyces until they fall away with the ripe pod and seed. Bracts of the softer, oblong spike in *D. piptostegia* are on the contrary thrown off before the flower expands; they are, moreover, more narrowly ovate in outline and of thinner texture.

With the typus of *D. piptostegia*, a densely gray-pubescent plant, the leaflets clad on both sides with a silky-tomentulose, almost plushlike vesture, I here associate a habitally similar but green dalea collected in the same range of mountains, about 30 km further north across the state line in Puebla. These specimens (*Purpus 4147*) are at first sight very different, for the vesture is reduced to a remnant, although the hairs are individually of the same fine spiral type. Since several other *Versicolores* and *Tuberculatae* are known to exist in more and less densely pubescent aspects, the variation is not unlikely in the context of the group.

108. DALEA BICOLOR Humboldt & Bonpland ex Willdenow
(Plates XCIX–CII)

Fruticose when adult, but precociously flowering and highly variable in mature stature, usually bushy, rarely diffuse and trailing, occasionally becoming tall shrubs or treelets, (2) 4–20, rarely 35 dm tall, the old wood becoming fissured and striped lengthwise, the young branches prominently and usually densely tuberculate with mammiform or grainlike glands, pilosulous with ± curly, subappressed, or incurved, more rarely spreading hairs, the foliage green, greenish, or ashen, always at least thinly and inconspicuously pilosulous, often densely so, sometimes silky or satiny on one or both sides, or densely tomentulose, each main stem branching distally into panicle of spikes terminal to leafy branchlets usually surrounding and often surpassing the leaf-opposed, central spike; *leaf-spurs* 0.3–1.5 mm long; *stipules* narrowly triangular to subulate or linear-setiform, livid, either pubescent or glabrous, (0.5) 1–4.5 mm long; *intra-* and *post-petiolular glands* always present, often conspicuous; *leaves* shortly petioled, the primary cauline ones (0.6) 1–3.5 (4.5) cm long, with narrowly margined rachis and (1) 2–10 (11) pairs of obovate, oblong-elliptic, oblanceolate, obovate- or cuneate-obcordate, obtuse, retuse, or bluntly gland-mucronate, dorsally punctate leaflets (1.5) 2–9.5 mm long, the last pair arising at same point to form a palmate trefoil; *peduncles* 0–4 (5) cm long; *spikes* usually loose, with calyces subcontiguous or well separated, but sometimes closely contiguous, in Baja California sometimes extremely dense and almost conelike, without petals or androecia (4.5) 5.5–15 mm diam, the villosulous axis becoming (0.5) 1–20 (23) cm long; *bracts* rather tardily deciduous or, especially when small and low on the spike (or both) persistent through and even after anthesis, in dense spikes sometimes deciduous but held fast between the flowers, rhombic-ovate to broadly ovate, ovate-acuminate, lanceolate-caudate, or sometimes narrowed downward from near or above middle

and then oblanceolate, 1–5.5 (6) mm long, dorsally puberulent to densely pilose, livid and glandular beneath the vesture, the tips often glabrate, usually appressed-pilosulous or at least puberulent internally, in var. *orcuttiana* sometimes internally glabrous; *calyx* 2.5–5.6 (6.8) mm long, variably pubescent, the tube often yellow or castaneous, 1.6–3.2 mm long, the ribs thickened and usually prominent, the intervals charged with 1 row of ± 2–3 (4) glands, the deltate-ovate to triangular-apiculate or -acuminulate, often gland-spurred teeth unequal, the dorsal one nearly always a trifle, often much longer than the rest, 0.5–2.9 (3.8) mm long, with rare exceptions shorter than the tube; petals bicolored, the banner opening white or creamy yellow, early rubescent, the epistemonous ones rose-purple, phlox-purple, lilac, violet, or vivid cobalt blue, perched well below middle of androecium, usually all glandless but the banner or keel (or both) rarely tipped with a minute gland; *banner* 3.2–7.5 (8) mm long, the claw 1.4–3.4 (4) mm, the deltate-cordate blade (2.2) 2.8–4.8 (5.8) mm long, 2.4–5.2 mm wide; *wings* 3.4–7.5 mm long, the claw 0.8–2.7 mm, the broadly lance-oblong to ovate-elliptic blade 3.6–5.5 mm long, 1.8–3 mm wide; *keel* 5–10 mm long, the claw 1.2–3.6 (4) mm, the ovate-elliptic blades 3.6–7 mm long, 2.1–4.4 mm wide; *androecium* 10-merous, 5.6–10.5 (12) mm long, the filaments free for (1.7) 2–4 mm, the connective gland-tipped, the anthers 0.65–1 mm long; *pod* 2.2–2.7 mm long, variable in outline, in profile obovate to triangular, the ventral side as long or longer than the others, the slender prow convex or straight, the style-base excentrically terminal or latero-terminal, the valves thinly papery above the hyaline base, sparsely gland-dotted, distally pilosulous or rarely glabrous.

As defined by the description, *D. bicolor* is an assemblage of many small races adapted to an immense altitudinal and climatic range. By accretion around a nucleus of what has been known historically as *D. tuberculata* Lag. it has come to embrace so much diversity in form and detail that a comprehensive portrait becomes an abstract formula, portraying the parameters of total variation (or attempting to do so), but no particular plant.

Characters common to the components of *D. bicolor* sens. lat. are: prominently warty stems; foliage at least puberulent, often densely gray or even silky pubescent; leaflets of primary leaves mostly 3–9, rarely 2 or up to 11 pairs, neither very small nor greatly thickened; a relatively short-toothed calyx subtended by bracts tardily deciduous or persistent; and epistemonous petals of some shade of pink, purple, or blue, never yellow, contrasting in early anthesis with a white or pale yellow, soon rubescent banner. The distinguishing characters of several close relatives in central Mexico and southern Baja California cannot be usefully emphasized in context of the whole specific complex but are mentioned under the appropriate heading.

Several forms of *D. bicolor* have been noted as attractive to bees, which are sometimes seen in great numbers working the flowers for pollen and nectar. Herbarium specimens often show the keel-petals of even young flowers trodden down so as to expose the anthers, something that does not normally occur unless they have been visited by a heavy insect. In many flowers the style at full anthesis grows out a little beyond the keel-tip, which must facilitate cross-pollination.

The adoption for the species of the old name *D. bicolor* requires comment. Willdenow ascribed the name to Humboldt & Bonpland and thought the seeds had been brought from South America, but Bonpland, who grew the same plant at Malmaison (Pl. Rar. Malm. 142, tab. 56. 1816) from 1810 onward, states that he himself had brought the seed from Mexico. For reasons now impossible to trace the epithet *bicolor* was early transferred in horticultural literature to a cultivated form of *D. obovatifolia* passing at the time under the taxonomic synonym *D. mutabilis*. Bonpland grew the latter side by side with *D. bicolor* at Malmaison and Redouté's admirable drawings of both can be compared in

Pl. Rares Malm. tab. 57, 58. It appears that the genuine *D. bicolor*, which Bonpland recognized as more interesting than ornamental, did not endure in gardens, but the epithet did, at least for some years. attached to *D. mutabilis*. The last mention of genuine *D. bicolor* until modern times is perhaps that of George Don (1832). As early as 1823 we find *D. obovatifolia* (*mutabilis*) grown at Liverpool and figured by Hooker (Exotic Fl. **1**: tab. 43) as *D. bicolor*; the next year at Chelsea and figured by Sims (Bot. Mag. tab. 2486) as *D. mutabilis* but with *D. bicolor* (at least sensu hortulano) given as synonymous. In 1830 Schlechtendahl (Linnaea **5**: 612) identified the plate of Sims with the plant in Willdenow's herbarium (*No. 14117*) and the plate in Hortus Berolinensis, stating further that the species was in general stove culture at the time under the horticultural names *D. foetens* or *D. foetida*. I have not seen the actual specimen in herb. Willdenow., and am unable to judge whether it is relevant or not. Certainly the contemporary figures of *D. bicolor* given by Willdenow and Bonpland do not correspond with any known form of *D. obovatifolia* (*mutabilis*) and are, in my judgment, most highly suggestive of some phases of the species here treated that occur on the Mexican plateau in Mexico and Hidalgo. It is true that the stems are not shown strongly warty, as is generally the rule in *D. bicolor* as I interpret the species, but this could well be an effect of cultivation under glass in a northern climate.

Key to the Varieties of *Dalea bicolor*

1. Plants of continental Mexico e.-ward and s.-ward from Sierra Madre Occidental; either the spikes loose, or the calyx short-pubescent, or the dorsal calyx-tooth much shorter than tube, often two or three of these characters coinciding.
   2. Plants of centr. Oaxaca (in the pine belt) with small flowers, the *calyx* 2.5–3.2 mm, its tube 1.6–2.3 mm, the dorsal tooth 0.5–1 mm, the keel-blades 3.6–4.6 (5) mm long; *leaflets* of primary leaves 5–9 (10) pairs.
      108d. var. *naviculifolia*.
   2. Plants mostly allopatric (Puebla n.-ward), but if of central Oaxaca the *leaflets* only 3–6 pairs, or the calyx and keel-blades larger, commonly both.
      3. Leaflets of primary leaves mostly 3–6 pairs, if less numerous then green and glabrous to glabrescent above; widespread.
         4. Foliage loosely pilosulous or glabrescent, green or greenish, or if ashen then loosely and softly pubescent, not satiny; *spikes* either compact or loose and open; widespread, and intergradient with the next in n.-e. Mexico. 108a. var. *bicolor*.
         4. Foliage densely silky- or satiny pubescent on both sides; *spikes* relatively compact, mostly 0.5–4 cm long; Sierra Madre Oriental from w. Tamaulipas n. through e. Coahuila into trans-Pecos Texas and s.-e. New Mexico. 108b. var. *argyrea*.
      3. Leaflets of primary leaves 1–3 pairs, often 1–2 pairs, and densely satiny-pubescent in youth or permanently; *spikes* of var. *bicolor*, 1.5–12 cm long; Tehuacán Desert and vicinity, s. Puebla and adjoining Oaxaca.
         108c. var. *canescens*.
1. Plants of Baja California (between Sa. San Pedro Mártir and Sa. de la Giganta inclusive); *spikes* always moderately, sometimes extremely dense, the calyces contiguous; *calyx* usually densely and loosely pilose-pilosulous (hairs (0.5) 0.6–1.6 mm long); *dorsal calyx-tooth* at least 1.5 and up to 3 mm long.
   108e. var. *orcuttiana*.

108a. Dalea bicolor Humboldt & Bonpland ex Willdenow var. bicolor (Plate XCIX)

Fruticose when adult, becoming commonly a rounded many-stemmed bush 5–12 dm tall, but in barren or exposed sites sometimes diffuse or prostrate, in shade or in competing brush becoming a shrub with few slender crooked trunks irregularly branching distally, up to 2, exceptionally subarborescent and up to 3.5 m tall; *leaves* (0.7) 1–2.5 (3) cm long; *leaflets* (2) 3–6 rarely 4–9 pairs, 2–7 (8) mm long, varying from thinly pilosulous to glabrous above, green, greenish, or ashen; *spikes* usually elongating and loose from early anthesis, the flowers (pressed) either contiguous or separated by spaces over twice the width of a calyx, without petals or androecia 6–9 mm diam, the villosulous axis becoming (1) 1.5–23 cm long; *bracts* 1.5–3 (4) mm long; *calyx* (3.2) 3.4–5.2 mm, the loosely villous-pilosulous, subappressed-silky, rarely almost (quite) glabrous tube (2.1) 2.3–3.2 mm, the dorsal tooth 1–1.9 (2.2) mm long; *epistemonous petals* usually bright rose-purple, sometimes violet or vivid blue, sometimes pale rose-purple, the keel-blades 4.6–7 mm long; n = 14 (Spellenberg, 1973); 2n = 7_{II}, 28 (Mosquin). — Collections: 154 (xvii).

Stony hillsides, bouldery draws and dry washes, benches in barrancas, sometimes on rock-ledges, commonly in open places but s.-ward and on the Gulf slope entering thin oak woodland or drought-deciduous brush and thorn-scrub, sometimes colonial in hedges and at edge of fields, (500) 600–2700 m (mostly 2000–9000 ft), widespread, common, and often locally abundant from the margins of the Chihuahuan Desert in centr. Chihuahua and w.-centr. Coahuila s. over the Meseta Central to the middle Neovolcanic ranges from the basin of Lago Chapala, Jalisco e. to the w. foothills of Cofre de Perote and Orizaba in Puebla and adjoining Veracruz, extending s. to the edge of the Balsas Depression in Morelos, s.-e. México and adjoining Michoacán, and s. from Puebla interruptedly through the upper Papaloapan drainage and foothills of Mixteca Alta into centr. Oaxaca; apparently disjunct on summit of Sierra de Tamaulipas, Tamaulipas; in centr. Coahuila and along n. Sierra Madre in Nuevo León intergrading with var. *argyrea*, in s. Puebla and Oaxaca with vars. *canescens* and *naviculifolia*. — Flowering June to January, most abundantly and dependably from August to November. — *Representative*: Tamaulipas: *Martínez & Borja F-1916* (TEX). Chihuahua: *Pringle 301* (BR, F, GH, NY, US); *Ripley & Barneby 13,914* (NY). Coahuila: *Palmer 162* (C, F, NY, UC, US); *Pringle 2400* (BR, F, M, NY, UC, US, W, Z); *Ripley & Barneby 13,275* (CAS, MEXU, NY, US). Nuevo León: *M. Taylor 229* (F, UC, TEX); *Lucás 103* (F); *Ripley & Barneby 13,295* (NY). Durango: *Palmer 516* (F, GH, NY, UC, US); *Gentry 6885* (NY), *6895* (ARIZ); *Mosquin 6887* (NY, diploid). Zacatecas: *Pringle 1755* (BR, F, M, SD, UC, W); *Gentry 6890* (NY); *Mosquin 6855, 6856, 6857* (flowers pink, white, purple respectively, all tetraploid, NY). Aguas Calientes: *Hartweg 64* (K, NY, W); *Mosquin 6858* (NY, tetraploid). San Luis Potosí: *Ripley & Barneby 13,770* (CAS, NY), *14,761* (CAS, MEXU, NY, US); *Parry & Palmer 156, 158* (BR, F, NY). Guanajuato: *Kenoyer 1780* (GH); *Sohns 495* (UC). Querétaro: *Rose, Painter & Rose 9512, 11,162* (NY, US). Hidalgo: *Matuda 4397* (NY), *19,625* (US); *Gilly 69* (F, NY); *Ripley & Barneby 13,630* (CAS, NY). Jalisco: *Shreve 9295* (ARIZ, UC). Michoacán: *Ripley & Barneby 13,402* (CAS, MEXU, NY), *13,436* (CAS, MEXU, NY), *14,804* (CAS, NY); *Hinton 13,397* (F, NY, US); *Arsène 5825* (F, GH, L, NY). México: *Pringle 9742* (F, NY, L, Z); *Hinton 2327* (GH, NY, UC, US); *Ripley & Barneby 14,354* (CAS, NY, US). Distrito Federal: *Bilimek 124* (BR, C, NY, UC); *Orcutt 4353* (F, GH). Morelos: *Paray 1294* (ENCB). Puebla: *Balls 5529* (GH, K, UC, US); *Pittier 409* (US). Veracruz: typus of *D. thymifolia*. Oaxaca: *E. W. Nelson 1646* (NY); *Seler 1522* (US); *Ripley & Barneby 13,671* (NY), *14,670* (CAS, MEXU, NY, UC, US).

Dalea bicolor Humb. & Bonpl. ex Willd., Hort. Berol. pl. 89. 1809. — "Habitat in America meridionali. Dalea bicolor *de Humb. & Bonpland.*" — No typus seen, but a spm is to be sought in herb. Willd., B. — *D. bicolor* sensu Bonpl., Pl. Rar. Malm. 142, tab. 58. 1819, the locality there corrected to Mexico. — *Parosela bicolor* (H. & B. ex Willd.) Rydb., N. Amer. Fl. **24**: 83. 1920, quoad nom., exclus syn. et descr.

Dalea tuberculata (warty, of the stems) Lag., Gen. & Sp. Nov. 23. 1816. — "Habitat in Nov. Hisp. Semina adportavit prael. D. Sessé..." — No typus found at MA, but the traditional interpretation is confirmed by the protologue and Plate 136 of Sessé & Mociño Calques at G (= *Field Neg. 30,607*, F), so labelled. — *Parosela tuberculata* (Lag.) Rose, Contrib. U. S. Nat. Herb. **10**: 104. 1906.

Dalea thymoides (resembling in habit common thyme, *T. vulgaris*) Schlechtd. & Cham. Linnaea **5**: 580. 1830. — "Inter Hacienda de Tenestepeque et Hacienda de Quantotalapa in sylvaticis. Sept." — No collector mentioned in the protologue, but this supplied by Schlechtd., Linnaea **12**: 292. 1838: holotypus, *Schiede & Deppe 617*, formerly B, not seen; isotypus W!

Dalea laevigata (smooth) G. Don, Gen. Hist. Dichl. Pl. **2**: 224. 1832. — "Native of Mexico...(v. s. in herb. Lambert.)." — Presumed holotypus, labelled "*Dalea* sp. nov. de Mexico" with epithet "*laevigata*" added in another hand, perhaps G. Don's, OXF!

Dalea verrucosa (warty) G. Don, Gen. Hist. Dichl. Pl. **2**: 225. 1832. — "Native of Mexico...(v. s. in herb. Lambert:)." — Presumed holotypus, labelled "*Dalea* sp. nov. de Mexico" with annotation in same hand as above "*D. verrucosa*", OXF!

Dalea comosa (with flowers arranged in a pigtail plait, as *Polygala comosa* Schkuhr) Schlechtd., Linnaea **12**: 289. 1838. — "Mineral del Monte; Cuesta blanca, Nov., Dec. (C. Ehrenberg)." — Holotypus, formerly B, not seen, but the protologue decisive.

Dalea ehrenbergii (Carl August Ehrenberg, 1801-1849) Schlechtd. in op. cit. 290. 1838. — "...ad aquas calidas pr. Grande [= Atotonilco, n. of Pachuca, Hidalgo] (C. Ehrenberg)." — Holotypus, formerly B, not seen, but the detailed protologue decisive.

Dalea seemanni (Berthold Carl Seemann, 1825-1871) Wats., Proc. Amer. Acad. **22**: 470. 1887 ("*Seemani*"). — "Collected by Seeman in the Sierra Madre, probably in Durango, and by C. R. Orcutt at Socono [= Socorro], in Lower California, April, 1886." — Holotypus, *Seeman s. n.* [from Durango], GH! the paratypus (*Orcutt*) = var. *orcuttiana* Barneby. — *Parosela seemanni* (Wats.) Rose, Contrib. U. S. Nat. Herb. **10**: 106. 1906.

Parosela tuberculina (tuberculate, of the stems) Rydb., N. Amer. Fl. **24**: 89. 1920. — "Type collected in the vicinity of San Luis Tultitlanapa, Puebla, July 1908, *Purpus 3215*..." — Holotypus, NY! isotypi, F, GH, UC, US! — *Dalea tuberculina* (Rydb.) F. J. Hermann, Jour. Wash. Acad. Sci. **38**: 237. 1928.

Parosela longeracemosa (with long spikes) T. Brandg., Univ. Calif. Pub. Bot. **10**: 184. 1922. — "Collected at Minas de San Rafael, San Luis Potosí, No. 4839." — Holotypus, collected by C. A. Purpus, Nov 1910, UC!

The var. *bicolor* is the commonest purple-flowered shrubby dalea of the Mexican Plateau, characterized by the combination of warty stems, relatively few (usually only 3-6) pairs of leaflets, and narrow spikes of short-toothed calyces subtended by long-persistent bracts. The variety is composed of a mosaic of local races that differ in amount and orientation of pubescence, in density and length of spikes, in exact number (and to some degree shape) of leaflets, and in color of the epistemonous petals, which vary from pale rose-purple through vivid phlox-purple to violet or (less often) cobalt blue. To the field observer, however, these variable features are quite overshadowed by the extraordinary plasticity of habit and stature. On the Central Plateau north of the Bajío, the average adult plant of var. *bicolor* forms a rounded, more or less erect, many-stemmed bush up to about a meter tall, but the potential stature is not achieved in exposed places; on the other hand even in desert Coahuila plants twice that height are found in sheltered hollows of canyon washes. In the more benign climate of the Neovolcanic mountains a stature of two meters is normal, the plants there forming thin erect shrubs consisting of a few crooked leafless trunks bearing aloft a bushy head. In eastern San Luis Potosí, where

var. *bicolor* descends into the edge of the relatively moist oak woods of the Gulf slope, it is possible to stand in the shadow of arborescent specimens and reach or even jump for the lowest flowers. By contrast on the thin pumice soils at the foot of Cofre de Perote and Orizaba in eastern Puebla and adjoining Veracruz var. *bicolor* is represented by a lowly, depressed or humifuse ecotype, described long ago as *D. thymoides* Schlechtd., of which the most vigorous individual rises no more than one or two decimeters from the ground.

Field experience suggests that the extent to which habital differences are inherited and imposed on the individual by environment varies from one population to another. Possibly, therefore, within comprehensive var. *bicolor* there may lie concealed by random variation elsewhere in the complex some genetically stabilized entities. But when a summit branchlet taken from a tall shrub in Michoacán is (in the herbarium) indistinguishable from the whole stem, cut at the root, of some northern xerophytic bushlet, taxonomic discrimination founders. The discovery by Mosquin of tetraploid var. *bicolor* in Aguas Calientes and Zacatecas indicates genetic ferment within the species, but unfortunately it seems impossible to distinguish by means of exterior morphology between known diploid and known tetraploid specimens.

Notable variations other than those involving habit and stature and largely independent of either are expressed in length of spike, leaflet number, and pubescence of the calyx. The extreme conditions of the spike are on one hand a subcapitate to shortly oblong cluster of 7–20 flowers with calyces subcontiguous, on the other a series of 50 or more flowers strung out, distant each from the next by its own wideth or more, along a flexuous axis up to two decimeters long. In the arid climate of the Central Plateau the leaflets are commonly 3–6 pairs in primary cauline leaves, but these rise (inconsistently) to 5–9 pairs in Michoacán and southeast México. In the barrancas high on the Gulf slope in Hidalgo, and sporadically elsewhere, the calyces become densely villous with longer hairs, the minor variant recognized by Rydberg (1920, p. 88) as *Parosela seemanni*.

Along the eastern edge of its range var. *bicolor* passes successively into the next three varieties, only the last of which is at all strongly characterized. The dominant race in western Coahuila and adjoining central Chihuahua is at once densely and loosely pubescent with ordinarily short spikes (as in var. *argyrea*) but villosulous calyces. A prostrate or diffuse variant of this more commonly bushy and erect variant, similar to the diffuse states already noted from further south, was annotated by I. M. Johnston (see especially *Stewart 52,515* etc., GH) as a species nova, but lacks convincing differential characters.

The var. *bicolor* is sympatric over parts of its range with several more or less closely related species and seems to give rise occasionally to fertile hybrids. Near Zimapán, Hidalgo, colonies of *D. dorycnioides*, there extremely abundant on arid limestone, interfinger along water-courses through the hills with thin stands of *D. bicolor*, and seemingly intermediate individuals are found between them (*Ripley & Barneby 13,618*, NY). In municipio Jacala, Hidalgo, a plant combining the growth-habit and narrow panicle of spikes characteristic of *D. tomentosa* with the relatively large bicolored flower of *D. bicolor* (*Moore 5030*, BM, GH, MEXU, UC) suggests another interspecific cross.

On the headwaters of Rio Conchos in southern Chihuahua a form of var. *bicolor* is recorded as furnishing "significant animal food" (*Pennington 349*, TEX) with a vernacular name *carnero*.

108b. Dalea bicolor Humboldt & Bonpland ex Willdenow var. argyrea (Gray) Barneby

(Plate C)

Low shrubs, up to 9 dm tall, mostly less, the stems usually erect, forming plants of ± rounded bushy outline; *leaves* 1–3.5 cm long; *leaflets* (2) 3–6 pairs, (2) 3–9 mm long, densely satiny- or velvety-pilosulous both sides, rarely glabrescent and greenish;

spikes comparatively compact, ovoid becoming cylindroid, without petals 8–10 mm diam, the axis 0.5–4 cm long; *calyx* (3.5) 3.8–5 mm long, densely short-pubescent, the tube 2.6–3.2 mm, the dorsal tooth 0.8–2 mm long; *petals* of var. *bicolor*. — Collections: 30 (ii).

Open stony hills and benches of canyons, ascending (s.-ward) into the oak-belt, locally plentiful, sometimes forming thickets, 450–2070, strongly but not obligately calciphile, w. Texas (n.-w. from mouth of Devils River, Val Verde to Culberson Co.) and immediately adjoining s.-e. New Mexico s. through detached ranges in Coahuila to the n. Sierra Madre Oriental in Nuevo León and adjoining Tamaulipas, extending s. to or slightly beyond the Tropic of Cancer. — *Representative*: UNITED STATES. NEW MEXICO. Eddy: *Steiger 461* (NY); *Barneby 2594* (NY). TEXAS. Culberson: *Warnock 9565* (OKLA, TEX); *Waterfall 5754* (NY, OKLA). Presidio: *Hinckley 830* (NY). Brewster: *Warnock 21,016* (TEX). Val Verde: *Cory 37,972* (TEX). MEXICO. COAHUILA: V. Acuña: *Marsh 581* (F, GH, OKLA). Melchor Múzquiz: *Stewart 1308* (GH); *Marsh 1349* (GH, OKLA, TEX). Cuatro Ciénegas: *Johnston 8381* (GH). Arteaga: *Ripley & Barneby 13,285* (CAS, NY). NUEVO LEÓN. Monterrey: *Edwards s. n.* (NY). TAMAULIPAS. Cd. Victoria: *Gentry 6753* (ARIZ, UC, US). Jaumave: *von Rozynski s. n. in 1931* (NY, UC). _____ : *Berlandier 783* (NY, P), *2203* (F, NY, P).

Dalea bicolor H. & B. ex Willd. var. **argyrea** (Gray) Barneby, stat. nov., based on *D. argyrea* (silvery, of the foliage) Gray, Pl. Wright. **1**: 47. 1852. — "High hills near the San Pedro [now Devils] River [Val Verde Co., Texas], abundant; July. (San Antonio de las Alanzanes, Mexico, *Gregg*, no. 357. Southern frontiers of Texas, Dr. Bigelow)." — Holotypus, *C. Wright 131*, collected 30 Jul 1849, GH! isotypi NY, OXF! paratypi (*Gregg, Bigelow*), GH! — *Parosela argyrea* (Gray) A. Hell., Catal. N. Amer. Pl., ed. 2, 5. 1900.

Parosela paysoniae (Lois Butler, 1895– , m. Edwin Blake Payson) L. O. Wms., Bull. Torrey Club **61**: 252. 1934. — "*Lois B. Payson 37,* September 27, 1931, rocky slopes near Carlsbad Caverns..." — Holotypus, RM!

Although Gray believed *D. argyrea* to be very distinct from all known North American species with the possible exception of *D. argentea* Mart. [now identified as *D. tomentosa* (Cav.) Willd.], it is in reality only to be distinguished with difficulty from *D. bicolor* var. *bicolor*, and then only by placing an inordinate emphasis on the silvery or satiny pubescence of the foliage, a notoriously weak differential character in *Dalea*. With silvery pubescence we find generally associated a relatively compact and short spike, but this is not diagnostic. As already noted under var. *bicolor*, the limit between it and var. *argyrea* is indefinite in west-central Coahuila, although all known collections from the Serranías del Burro seem to be of the *argyrea* type. In Jaumave valley, where the variety has been collected often, there occurs a variant with greenish foliage (*Graham & Johnston 4145*, UC) which cannot be separated technically from some forms of var. *bicolor* from the interior plateau. Thus var. *argyrea* has little more claim to taxonomic recognition than several minor variants already described briefly under var. *bicolor*. In southeastern New Mexico Spellenberg (no. *3675*, NY) found a form of var. *argyrea* with prostrate-ascending woody stems that rooted where in contact with the soil, in the manner of *D. frutescens*.

108c. DALEA BICOLOR Humboldt & Bonpland ex Willdenow var. CANESCENS (Martens & Galeotti) Barneby

(Plate C)

Leaves 1–2.5 cm long; *leaflets* 1–3 pairs, obovate-cuneate to obovate, 4.5–9.5 mm long, densely long-silky, when young satiny-canescent above, greenish in age;

spikes 1.5–12 cm long, essentially as var. *bicolor*, without petals or androecia 7.5–10 mm diam; *calyx* 3.9–5 mm long, the tube 2.5–3.1 mm, the dorsal tooth 1.2–2.3 mm long. — Collections: 16 (ii).

Rocky hills and terraces of barrancas, 1500–1900 m (5000–6330 ft), strongly calciphile, but found also on pumice-ash, locally plentiful and widespread through the thorn-scrub-cactus associations of the Tehuacán Desert and vicinity, in s.-e. Puebla and adjoining Oaxaca. — Flowering (July) August to January. — *Representative*: PUEBLA. Tehuacán: *Pringle 6690* (F, M, NY, UC, W, Z); *Liebmann 4607* (F, UC, US, W, Z); *Rose & Painter 9884* (NY, US). Zapotitlán de Salina: *Ripley & Barneby 14,711* (NY). Caltepec: *Purpus 2652* (P, UC). OAXACA. Huahuapan de León: *Ripley & Barneby 13,641* (CAS, MEXU, NY).

Dalea bicolor H. & B. ex Willd. var. **canescens** (Mart. & Gal.) Barneby, stat. nov., based on *D. canescens* (whitening, of the leaflets) Mart. & Gal., Bull. Acad. Brux. **10**[2]: 43. 1843. — "...se trouve sur les monticules calcaires où croissent diverses espèces de Cacteae, l'*Echeandia graminea* nobis, près de Tehuacan de las Granadas (Puebla) à 5,500 pieds..." — Holotypus, *Galeotti 3219*, collected in Aug 1840, BR (herb. Galeot.)! isotypi, BR (herb. Mart.), P! — *Parosela canescens* (M. & G.) Rose, Contrib. U. S. Nat. Herb. **10**: 105. 1906.

A poorly differentiated variety, resembling var. *bicolor* closely in the inflorescence, which varies from long, loose and tapering to moderately compact and oblong, and in fine detail of the calyx and corolla. The pubescence of the leaves is like that of var. *argyrea*, but the comparatively few (1–3) pairs of leaflets are distinctive. Rydberg attributed to *Parosela canescens* longer bracts than to *P. argyrea*, but there is only a slight average difference in this feature, which is variable in all forms of the species. The var. *canescens* was collected first in 1827 by Karwinski (M).

108d. DALEA BICOLOR Humboldt & Bonpland ex Willdenow var. NAVICULIFOLIA (Hemsley) Barneby

(Plate CII)

Small shrubs, depressed and trailing or erect and freely branching, up to 7 dm tall but mostly less; *leaves* 6–26 mm long; *leaflets* (4) 5–9 (10) pairs, oblong-elliptic to oblanceolate or narrowly obovate navicular or loosely folded, obtuse but gland-mucronulate, 1.5–4 (4.5) mm long, green or ashen, either glabrous or thinly pubescent above; *spikes* loose or moderately dense, in outline narrowly lanceolate to linear-oblong, without petals 4.5–6 mm diam, the axis becoming (1) 1.5–6 (9) cm long; *bracts* ovate-acuminate, 1–1.7 mm long; *calyx* 2.5–3.2 mm long, the tube 1.6–2.3 mm, either glabrous below the teeth, puberulent from middle upward, or puberulent throughout, the teeth ovate or triangular, the dorsal one 0.5–1 mm long; *petals* of var. *bicolor* but small, the keel-blades mostly 3.6–4.6, rarely 5 mm long. — Collections: 9 (iii).

Cool exposures of steep mountainsides and grassy glades in pine-oak woodland, 1935–2250 m (6450–7500 ft), locally abundant but apparently confined to the Mixteca Alta, especially on headwaters of Río Tomellín, n.-centr. Oaxaca. — Flowering September to January. — *Material*: MEXICO, s.l., *Karwinski in 1827* (M). OAXACA. Asunción Nochixtlán: *Ripley & Barneby 14,590* (CAS, MICH, NY, UC, US), *14,597* (NY); *Seler 1522* (US). Nazareno Etla: *Conzatti 4206* (MEXU); *Pringle 6017* (BR, ENCB, F, GH, K, M, MEXU, NY, SD, UC, US, W); *L. C. Smith 886* (GH); *Ripley & Barneby 14,666* (CAS, DAO, MEXU, US).

Dalea bicolor H. & B. ex Willd. var. **naviculifolia** (Hemsl.) Barneby, stat. nov., based on *D. naviculifolia* (with boat-shaped leaflets) Hemsl., Diag. Pl. Nov. 7. 1878. — "Mexico: *Bates*, sine loco..." — Holotypus, K! — *Parosela naviculifolia* (Hemsl.) Rose, Contrib. U. S. Nat. Herb. **10**: 104. 1906.

The typus of *D. naviculifolia* is notable for a combination of extreme characters none of which, however, is wholly foreign to var. *bicolor*. It follows that a description of var. *bicolor* wide enough to encompass all its known variants very nearly encompasses *D. naviculifolia*. The small flower associated with the epithet *naviculifolia* is nearly matched for size in some specimens of var. *bicolor* in which the calyx is silky-pilosulous and combined with relatively few and large leaflets. A glabrescent calyx, which Rydberg (1920, p. 69) stressed as a differential character of *Parosela naviculifolia* is sometimes found in var. *bicolor*, but there associated with a larger flower and leaflets larger but either few or many. Until recently the range of var. *naviculifolia* seemed to lie safely beyond the orbit of var. *bicolor*, but this supposed allopatry has proved illusory. Typical var. *bicolor* has been traced south into Mixteca Alta near Nochixtlán (*Ripley & Barneby 13,671*) and occurs on limestone hills at the north end of the valley of Oaxaca, within a few kilometers of typical var. *naviculifolia*, although this occupies a cooler habitat at greater elevations. Plants from the last named locality (*Ripley & Barneby 14,670*) have flowers hardly larger than that of var. *naviculifolia*, but leaflets not over six pairs and a densely villous calyx. It appears that var. *naviculifolia* represents a dwarf montane race of *D. bicolor* in which several variable characters coincide at or close to the limit of variation within the species sens. lat.

108e. DALEA BICOLOR Humboldt & Bonpland ex Willdenow var. ORCUTTIANA Barneby

(Plate CI)

Erect or diffuse shrubs 3–12 dm tall; *leaves* 1–3.5 (4.5) cm long; *leaflets* 4–10 (11) pairs either softly gray-tomentulose or -pilosulous both sides or glabrous and green above and pilosulous to thinly puberulent beneath; *spikes* moderately dense to greatly congested and conelike, permanently ovoid or becoming cylindroid, without petals or androecia (8) 9–15 mm diam, the axis (1) 1.5–6 cm long; *bracts* densely pilose; *calyx* 4.3–5.6 (6.8) mm long, pilose or pilosulous with ascending-spreading hairs up to 0.5–1.2 mm long, the tube 2.3–3 (3.2) mm, the dorsal tooth 1.6–3 mm long (exceptionally up to 0.8 mm longer than tube, usually at least a trifle shorter); *keel* 6.8–9.1 (10) mm long, the blades (4.5) 5–6.2 (7) mm long, (2.5) 2.7–3.6 mm wide; n = 7 (Spellenberg, 1973). — Collections: 41 (o).

Desert washes, rocky crests, boulder-strewn hillsides and canyon-terraces, sometimes on cliff-ledges, near sea-level up to 1250 m (4170 ft), widely but interruptedly dispersed through Baja California in lat. 25°–31° N, from San Matias Pass at n. end of Sierra San Pedro Mártir s. (sometimes with *Idria*) through the deserts and detached mountain ranges toward the Gulf side of the Peninsula the length of Sierra de la Giganta. — Flowering February to May and (especially s.-ward, following summer rains) August to October. — *Representative*: BAJA CALIFORNIA (Edo): *Harbison 21,816* (SD); *Wiggins 5257* (F, NY, UC, US); *Raven et al. 12,487* (GH, UC), *12,646* (GH); *J. H. Thomas 7983* (NY); *Moran 9656* (SD, NY), *11,424* (SD), *7975* (NY, SD), *7889* (NY, SD). BAJA CALIFORNIA (Terr. Sur): *Moran 11,587* (SD); *Gentry 4162* (ARIZ); *Carter & Moran 5351* (NY); *Carter 4396, 4807, 4891, 5033* (all NY, UC).

Dalea bicolor Humb. & Bonpl. ex Willd. var. **orcuttiana** (Charles Russell Orcutt, 1864–1929) Barneby, var. nov., a var. *bicolori* imprimis spica conferta simul ac bracteis cum

calycibus dense plumoso-pilosulis ciliatisque necnon patria peninsulari (nec continentali) abstans. — BAJA CALIFORNIA (Edo): Socorro, 14 Apr 1886, *C. R. Orcutt.* — Holotypus, NY; isotypi, F, NY, UC, US. — *Dalea seemanni* sensu Wats., Proc. Amer. Acad. **22**: 470, pro parte (*Orcutt 1329*, GH), exclus. typ.

Parosela megalostachya (with big spikes) Rose ex Rydb., N. Amer. Fl. **24**: 102. 1940. — "Type collected at San Esteban, Lower California, 1889, *T. S. Brandegee...*" — Holotypus, collected 17 Apr 1889, US! isotypi, NY, SD, UC, US! — *Dalea megalostachya* (Rose ex Rydb.) Wiggins, Contrib. Dudl. Herb. **3**: 54. 1940.

A small xerophytic, drought deciduous shrub of desert washes and canyons, with either gray or green foliage and many ovoid or oblong heads of handsome rose-purple flowers. It is the common fruticose true dalea of the middle peninsular region of Baja California, sympatric with several species of *Marina* but only one species of *Dalea*, the rare *D. purpusii*, very distinct by reason of its few leaflets and long feathery calyx-teeth. Two related congeners, *D. brandegei* and *D. trochilina*, endemic to the region of Magdalena Bay and the Cape mountains respectively, are in many respects similar but in practice set off by truly glabrous stems and foliage.

Variation in var. *orcuttiana* follows the same general course as in its continental counterpart, var. *bicolor*: leaves densely gray-pilosulous to green and glabrescent; leaflets variable in number, ± 4–10, rarely 11 pairs; spikes variable in length, diameter, and density; calyx-hairs variable in length; and relative proportion of calyx-tube and -teeth unstable. As in var. *bicolor* the variations are not all of random nature. The populations in Sierra de la Giganta, so well collected by Carter, have green, thinly pubescent foliage and (nearly always) numerous leaflets, in primary leaves usually 6–10, rarely only 5 pairs; northward the leaflets are usually gray-pubescent and mostly 4–6 pairs. An incipient racial differentiation can be demonstrated, but not as yet any substantial morphological discontinuity. In this green southern form, interpreted by Wiggins (1940, p. 53) as transitional to *D. trochilina* (q.v.), the spikes are moderately dense, mostly 1.5–6 cm long and (without petals) 10–12 mm diameter.

North from latitude 27° N consistently ashen foliage is associated with a great variability in density and diameter of the spikes, which may be exactly as in Sierra de la Giganta or contracted into a conelike head up to 13–15 mm diameter by only 1–3 cm long. The range of the densely spicate phase is discontinuous and lies entirely within that of the narrow-spiked form. It has been collected in San Pedro Mártir (Providencia Canyon; Los Emes; Arroyo Agua Amarga), in Sierra San Borja (28° 43′ N), and shortly south of the territorial boundary at San Pablo (*Purpus 99*, ARIZ, UC, US). The typus of *Dalea megalostachya*, from San Esteban (27° 20′ N, ± 50 km w. of San Ignacio; cf. Moran, 1952, p. 254) is thought to be no more than an extreme form in which the calyx, corolla, and androecium simultaneously attain a size approached but not really matched elsewhere in var. *orcuttiana* as now known. Wiggins (1940) has treated *D. megalostachya* as a narrow endemic known only from the vicinity of the type-station, but in light of the many collections made recently in the central peninsula by Moran and others this interpretation seems hardly tenable. If *D. megalostachya* indeed deserves taxonomic recognition and the same standards were applied to continental populations of *D. bicolor*, there would be no visible end to the segregation of individual populations unique in some particular combination of qualities. However, since the typus of *D. megalostachya* does transcend expected limits of variability and may, after all, represent a genetically differentiated form of some stature, its name is best preserved in abeyance for it alone, and not stretched to cover all of its common relatives on the peninsula, which have passed as *D. seemanni* Wats. I here exercise the privilege of applying to *D. seemani* auct. (= *Parosela seemani* sensu Rydb., 1920, p. 88, pro parte, as to the Baja Californian element) a new varietal epithet, reserving in case of need for the form with conelike spikes of large flowers the formula **D. bicolor** var. **orcuttiana** fma. **megalostachya** (Brandg.) Barneby, stat. nov.

The existence of a concept equivalent to the original *D. seemani*, based on a mixture of var. *bicolor* from Durango and var. *orcuttiana* from San Pedro Mártir, and its subsequent acceptance by Rydberg, speak eloquently of the close essential similarity between these peninsular and continental expressions of their species. Indeed they seem to differ in no one firmly reliable morphological character but rather in a combination of several which tend together to exceed in a given direction the extreme recorded for the other. In habit, foliage, and pubescence the two are fully confluent. The coincidence of relatively dense spikes, densely villous calyces, and relatively long calyx-teeth, fortified by a disjunct range at desert elevations, nevertheless points to a biological parting of the ways in time and in adaptation.

109. DALEA CHOANOSEMA Barneby

(Plate CII)

Perennial herbs with slender, erect, purplish-castaneous, sparsely gland-tuberculate stems up to 1 m tall, paniculately branching distally, rather densely but inconspicuously puberulent with fine, subappressed hairs up to 0.1–0.2 mm long, the foliage green, the leaflets glabrous or nearly so above, at least thinly pubescent and tuberculate beneath; *leaf-spurs* 0.5–1 mm long; *stipules* slenderly subulate, livid, becoming dry and fragile, 0.8–1.5 mm long; *intra-* and *post-petiolular glands* small but prominent, hemispherical, glabrous; *main cauline leaves* ± 2–2.5 cm long, shortly petioled, with slender, very narrowly margined rachis and 4–5 pairs of broadly oblanceolate to nearly obovate, obtuse or truncate-emarginate, flat leaflets, those of the terminal trefoil largest, up to 5–6 mm long, the rameal leaves similar but smaller, some upper ones with only 2–3 pairs of leaflets up to 2.5 mm long; *peduncles* terminal to main divisions of the panicle and to all the branchlets, 1–5 cm long; *spikes* moderately dense, the calyces subcontiguous but not wholly concealing the puberulent axis, without petals or androecia ± 7 mm diam, the flowers spreading-ascending, the axis 1–3 cm long; *bracts* persistent, broadly ovate abruptly acute or short-acuminate, 1–1.5 mm long, puberulent and gland-tuberculate dorsally, glabrous within; *calyx* ± 3.8 mm long, thinly pilosulous externally with subappressed hairs up to 0.25 mm long, the somewhat oblique orifice more densely ciliolate, the tube constricted near base, thence campanulate, 2.6–2.8 mm long, angulate by the scarcely prominent ribs, the firm intervals charged with 3–5 glands not vertically ranked into one series, the obtusely gland-tipped teeth unequal, the dorsal one longest, ovate, 1–1.2 mm long, the rest shorter, deltate-ovate, shortly acute, the ventral pair broader than long; *petals* at first bicolored, the banner opening whitish except for a purple tip, finally rubescent, its blade sparsely gland-sprinkled in the eye, the inner ones bright purple, glandless, elevated only 0.4–1.2 mm above hypanthium rim; *banner* ± 6 mm long, the claw 2.5 mm long, dilated upward, the erect, suborbicular, emarginate blade ± 4 mm long, nearly 5 mm wide, united across the base into a deep cornet; *wings* 5.8 mm long, the claw 1.6 mm, the oblong-ovate blade ± 4.6 mm long, 2.3 mm wide; *keel* 7.5 mm long, the claws 2.4 mm, the broadly elliptic blades 5.5 mm long, 3 mm wide; *androecium* 10-merous, 7.8 mm long, the longest filament free for 2.7 mm, the gland-tipped anthers 0.7 mm long; *pod* obliquely deltate in profile, 2.5 mm long, 2.5 mm wide, the style-base lateroterminal, the sutures filiform, the valves membranous in the lower half, thinly papery and pilosulous distally, the subhorizontal leading edge livid; *seed* ± 1.8 mm long.—Collections: 1 (typus).

Pine-oak woodland, on igneous bedrock, ± 2250 m (7500 ft), known only from the Sierra Madre del Sur near Chilpancingo, Guerrero. — Flowering November–December.

Dalea choanosema (with funnel-shaped banner) Barneby, sp. nov., *D. bicolori* H. & B. ex Willd. affinis, praesertim caulibus herbaceis elatis virgatis ultra medium laxe paniculatim ramosis, idcirco habitu toto absimilis; a *D. bicolori* var. *naviculifolia*, quoad calycis forma praesimili, foliolis pauci (4–5 nec 5–9)-jugis, corolla majori, vexillique lamina glandulis conspersa ulterius distat. — GUERRERO: Cerro de Alquitrán, cerca de Mazatlán, municipio de Chilpancingo, Dec. 6, 1966, *Jerzy Rzedowski 23,634*. — Holotypus in herb. Inst. Politécnico Nac. Méx. (ENCB).

This species seems close to *D. bicolor* sens. lat., from which it differs principally, and somewhat precariously, in habit of growth. Elsewhere in these pages I have repeatedly emphasized the facility with which daleas known to become eventually shrubby or even subarborescent can bear flowers toward the end of their first season, appearing annual or, if perennial, herbaceous; and I have found it necessary to reduce to synonymy several species originally defined in terms of duration of the root. Obviously I have been speaking here of individual plants that differ in stature due purely to age or to age modified by environmental circumstances. At the same time there are many daleas characteristically fruticose, just as there are many obligately herbaceous, dying back each year to a root-crown or caudex at level of the soil. I have seen a few seedling individuals of *D. bicolor* already in flower, but the mature plant of all its many forms becomes shrubby or suffruticose by the end of the first season. Thus I feel confident that *D. choanosema*, which has slenderly virgate, distally paniculate, herbaceous stems that have reached a height of a meter within the current year, cannot be accomodated within *D. bicolor*, even though I have found no important differential character where one would prefer to see them, in structure of the leaf or fruit. The form of *D. bicolor* that most nearly suggests *D. choanosema* is the Oaxacan *D. bicolor* var. *naviculifolia*; the two can be compared at Plate CII. The figures do not show the differences in habit, but the differences in flower-size and number of leaflets are instantly evident. The banner of *D. bicolor*, usually glandless, is exceptionally tipped with a small gland, but never gland-sprinkled about the eye of the blade. As compared with that of *D. bicolor*, the banner blade of *D. choanosema* is not only gland-sprinkled, but exceptionally ample, more erect, and contracted at base into an exceptionally deep and wide funnel-shaped well.

The one known locality of *D. choanosema* lies well outside the known range of *D. bicolor*. The latter, principally a species of the Mexican plateau, extends down the Sierra Madre Oriental into Puebla and on into central Oaxaca. It reaches the Lerma valley in Michoacán, and in the same state and adjoining México extends into the Neovolcanic belt, reaching the edge of the Balsas depression on the southern flanks of Nevado de Toluca. There is no record of *D. bicolor* from Sierra Madre del Sur, where it may perhaps be represented by *D. choanosema*.

110. DALEA BRANDEGEI (Rose) Bullock
(Plate CIII)

Low, prostrate or diffusely branching, eventually gnarled and crooked shrubs up to 5 (?) dm tall, glabrous to the inflorescence, the livid-castaneous branches thickly charged with prominent orange or purplish glands or warts, the foliage bright green or subglaucescent, the thick-textured leaflets smooth above, prominently gland-punctate beneath; *leaf-spurs* almost 0; *stipules* triangular-subulate, livid, 0.5–1.5 mm long, becoming dry and fragile; *intrapetiolular glands* 2, small; *post-petiolular glands* promi-

nent, obtuse; *leaves* shortly petioled, the main cauline ones (drought-deciduous) 1.5–4 cm long, with narrowly margined, punctate rachis and (4) 5–8 pairs of obovate-cuneate to broadly oblong-oblanceolate, emarginate, flat or loosely folded leaflets (2) 3–6 mm long, the leaves of axillary spurs (when present) shorter, with fewer smaller leaflets; *peduncles* terminal to branchlets and the first of each main axis leaf-opposed, 0.5–8 cm long; *spikes* moderately dense, becoming oblong in outline, without petals (8) 9–12 (13) mm diam, the villosulous axis (1) 1.5–4.5 cm long; *bracts* deciduous, rhombic-lanceolate or -oblanceolate, 2.5–4.5 mm long, dorsally pilosulous at least to middle, thence livid-castaneous and gland-charged, the tip ± acuminate; *calyx* 4.4–5.8 mm long, silky-pilose externally with fine spreading hairs up to 1–1.3 mm long, the tube 2.5–3 mm, the castaneous ribs prominent, the submembranous intervals charged with 1 row of 3–5 prominent orange or livid glands, the triangular-acuminate teeth unequal, the dorsal one 1.9–2.8 (3) mm long (as long as to 0.7 mm shorter than tube), the rest broader and shorter, all usually minutely gland-spurred and divergent in fruit; *petals* bicolored, the gland-sprinkled banner white but rubescent, the epistemonous ones purple, glandless, perched well below middle of androecium; *banner* 5.2–7.5 mm long, the claw 2.3–3.8 mm, the suborbicular-cordate, emarginate blade (2.9) 3.5–4.5 mm long, 3.4–5 mm wide, recessed at base into a cornet; *wings* 5–7.5 mm long, the claw 1.4–2.3 mm, the oblong-ovate blade 4.1–5.7 mm long, 1.8–2.9 mm wide; *keel* 7–8.5 mm long, the claws (2) 2.3–3 mm, the broadly obovate-elliptic blades 5–6.2 mm long, 3.3–3.7 mm wide; *androecium* 10-merous, 7–8.5 mm long, the longer filaments free for ± 2–2.5 mm, the connective gland-tipped, the anthers 0.6–0.8 mm long; *pod* pilose and gland-sprinkled distally, not seen ripe.—Collections: 7 (o).

Stony flats and low hills or bluffs along the ocean, in coastal fog-desert, below 50 m, local, known only from Bahías Magdalena and Sta. María on the Pacific coast of Baja California Sur in Lat. 24° 30′–25° N.—Flowering October to April, perhaps irregularly following rains.—*Material*: BAJA CALIFORNIA (Sur). Magdalena Bay, *Brandegee in 1889* (F, UC), *Orcutt 48* (F, NY, US), *Mason 1896* (F), *Solis 56* (MEXU). Magdalena Bay at Man-of-War Cove, *Moran 10,813* (SD). Santa Maria Bay, base of Mt. San Lázaro, *Moran 3538* (SD).

Dalea brandegei (Rose) Bullock, Kew Bull. **1939**: 195. 1939, based on *Parosela brandegei* (Townsend Stith Brandegee, 1843–1925) Rose, Contrib. U. S. Nat. Herb. **10**: 106. 1906, a substitute for *Dalea ramosissima* (much branched) Benth., Bot. Sulphur 11, Pl. 10. 1844.—"Bay of Magdalena."—Holotypus, collected by Hinds in nov 1839, K (herb. Benth., 1841)! isotypi, attributed to *Sinclair, Sinclair & Barclay*, or *Hinds & Barclay*, BM, K (herb. Hook.), NY (herb. Torr.)!—Non *Dalea ramosissima* Mart. & Gal., 1943.—*Parosela ramosissima* (Benth.) A. Heller, Catal. N. Amer. Pl. ed 2, 6. 1900.

A low xerophytic shrub that becomes gnarled and leafless during periods of drought but produces after rains pliant young branchlets (as illustrated) very like those of the related *D. trochilina*. The differential characters of the latter are mentioned specifically under the next entry, and are far more numerous than the difference in length of calyx-teeth by means of which Rydberg (1920, pp. 87, 107) artificially separated them off into different species-groups in *Parosela*. The only other dalea of the same type known to occur in Baja California is *D. bicolor* var. *orcuttiana*, handily distinguished by at least thinly and usually densely pubescent foliage and branchlets and by the vexillum devoid of glands. The latter extends south along the mountainous eastern slope nearly to the latitude of Magdalena Bay but is ecologically remote from the coastal desert of the Pacific shores. It is of interest to note how the ranges of these three daleas coincide, in a sharper focus, with those of vicariant perennial species of *Marina* ser. *Chrysorrhizae*, that of var. *orcuttiana* lying

entirely within the compass of that of *M. parryi*, while *D. brandegei* and *D. trochilina* collectively stand within that of *M. divaricata*, a polymorphic entity showing incipient differentiation into vicariant races along the same geographic lines. There is a difference of maturity in the two genera, however, the marinas in an early stage of fragmentation lacking sharp morphological or geographic discontinuities whereas the daleas, outlying members of a group more highly developed in and probably issuing from the Mexican Plateau, are cleanly and clearly separate.

111. Dalea trochilina T. Brandegee
(Plate CIII)

Shrubs, sometimes flowering precociously as a divaricately branched herb, becoming erect and either freely branched throughout or developing simple trunks paniculately branching distally, at anthesis 0.6–3 m tall, glabrous to the inflorescence, the purplish or livid young branchlets distally gland-verruculose, the foliage greenish-glaucescent, the small, thick-textured leaflets green above, prominently livid-punctate beneath; *leaf-spurs* 0.4–1 mm long; *stipules* subulate to narrowly triangular-acuminate, 0.6–1.5 mm long; *intrapetiolular glands* 2, small; *post-petiolular glands* prominent, mammiform; *leaves* shortly petioled, the main cauline ones 1.2–3 cm long, drought-deciduous, with narrowly margined, sparsely punctate rachis and mostly 4–6 (7) pairs of narrowly obovate or oblanceolate, bluntly gland-mucronulate, flat or loosely folded leaflets (1.5) 2–6 mm long, the spur-leaves shorter, with ± 2–4 pairs of smaller leaflets; *peduncles* terminal to all the branchlets, 0.5–5 cm long; *spikes* very dense, conelike, ovoid-conic becoming ovoid-ellipsoid, oblong, or subglobose, without petals 8–12 mm diam, the villosulous axis finally 0.7–2.5 (3) cm long; *bracts* tardily deciduous, the lowest broader and shorter than the rest, glabrous dorsally, the interfloral ones flabellate or oblanceolate below the abruptly short-acuminate tip, 2.5–4 mm long, dorsally pilosulous at base, or along the keel, or at the middle, thence livid and glandular, densely ciliolate, glabrous within; *calyx* 3.6–4.6 (5) mm long, densely silky-pilosulous with spreading hairs up to 0.5–0.9 mm long (the adaxial side sometimes glabrate), the tube 2.4–3 mm long, moderately recessed behind banner, the ribs becoming prominent, pinkish-brown, the flat submembranous intervals charged with 1 row of 3–4 minute (externally invisible) glands, the deltate- to triangular-acuminate, livid-castaneous, gland-spurred teeth unequal, the dorsal one longest and narrowest, 1–1.6 (2.2) mm long, the rest a little shorter and broader; *petals* bicolored, the banner whitish tipped at apex and at basal lobes with purple, the white area rubescent, gland-sprinkled, the epistemonous ones purple, eglandular, perched low on androecium (1.4–2.2 mm above hypanthium); *banner* 5.3–6.5 mm long, the claw 2.9–3.6 mm, the broadly reniform-cordate blade 2.6–3.3 mm long, 2.8–4.2 mm wide, hooded at apex and recessed at base into a cornet; *wings* 5.1–6.2 mm long, the claw 1.4–2 mm, the oblong-elliptic blade 3.6–4.7 mm long, 1.6–2.2 mm wide; *keel* 5.9–6.7 mm long, the claws 1.7–2.5 mm, the elliptic-obovate blades 4.1–5 mm long, 2.2–2.9 mm wide; *androecium* 10-merous, 8.5–11 mm long, the filaments free for ± 2.5 mm, the connective gland-tipped, the anthers 0.6–0.75 mm long; *pod* in profile semiovate, ± 2.5 mm long, hyaline at base, thinly pilosulous and minutely gland-speckled distally; *seed* ± 1.7 mm long. — Collections: 6 (o).

Open hillsides and brushy flats with oak (*Quercus devia* and *Q. idonea*) and madroño (*Arbutus peninsularis*) or pinyon, 1470–1800 m (4900–6000 ft), known only from the higher mountains (Sas. de la Laguna and de Victoria) on and near Tropic

of Cancer in Cape Region of Baja California. — Flowering November to May, perhaps irregularly through the year. — *Material*: BAJA CALIFORNIA (Sur). La Laguna, *Gentry 4370* (UC), *J. H. Thomas 7907* (NY), *Moran 7432* (ENCB, NY). Trail to La Laguna e. of Todos Santos, *Carter, Alexander & Kellogg 2436* (MEXU, MICH, UC). San Jorge to Chuparosa, e. side Sa. de Victoria, *Carter & Ferris 3341* (ARIZ, MEXU, TEX, UC). Chuparosa, *Brandegee in 1892* (F, GH, perhaps wrongly dated isotypi).

Dalea trochilina (of *Trochilus*, hummingbird, from the type-station, Rancho Chuparosa) T. Brandg., Proc. Calif. Acad. Sci. II, **3**: 220. 1892. — "...common about La Chuparosa and peculiar to the summits of the high mountains of the Cape Region..." — Holotypus, labelled "Sierra de la Laguna, Jan 22, 1890, *Brandegee 127*", UC! — *Parosela trochilina* (T. Brandg.) Rose, Contrib. U. S. Nat. Herb. **10**: 104. 1906. *Dalea seemannii* ssp. *trochilina* (T. Brandg.) Wiggins, Contrib. Dudl. Herb. **3**: 53. 1940.

Closely akin to *D. brandegei*, which it resembles in its glabrous stems and foliage, bicolored flowers, and gland-sprinkled banner, but different in its erect habit of growth, slightly fewer entire (not emarginate) leaflets, hard, conelike flower-spikes, broader and shorter calyx-teeth, and longer (relative to the calyx much longer) androecium. The two species are spatially and ecologically well separated, *D. brandegei* known only from coastal desert around Bahía Santa Magdalena near 112° W, 24° 30′–25° N, *D. trochilina* from grassy woodlands above 1400 m in the Cape mountains near 110° W. Wiggins (1940) interpreted *D. trochilina* as an outlying subspecies of *D. seemannii* (= our *D. bicolor* var. *orcuttiana*) differing only in glabrous stems and foliage, and linked to it by intermediate forms from Sierra Giganta. However the extremely condensed spike, short calyx-teeth, and gland-sprinkled banner together with allopatry and ecological differentiation provide strong grounds for maintaining it in the original specific category. If it must be subordinated in rank, it would be to *D. brandegei*, not to *D. bicolor*.

According to Brandegee there are sometimes three ovules in the forming pod of *D. trochilina*; but only the usual pair have been seen in all flowers dissected.

112. DALEA AENIGMA Barneby
(Plate CIV)

Dwarf, diffuse subshrubs, with arching or creeping woody stems adventitiously rooting where they touch the ground, ± 1–2.5 dm long, distally verruculose and purplish, pilosulous nearly throughout with short, contorted or incumbent hairs, the foliage greenish, the leaflets glabrous above, pubescent and gland-sprinkled beneath, the inflorescence densely silky pilosulous; *leaf-spurs* 0.3–0.8 mm long; *stipules* triangular-subulate, 0.8–1.2 mm long; *intrapetiolular glands* 0; *post-petiolular glands* prominent; *leaves* 6–15 mm long, shortly petioled or subsessile, with narrowly margined rachis and (3) 4–7 pairs of oblanceolate to narrowly obovate, obtuse to emarginate, loosely folded leaflets 1.5–5 mm long; *peduncles* mostly terminal to branchlets, 2–5 cm long, sometimes one leaf-opposed on the main stems; *spikes* dense but not conelike, ovate-oblong or the smaller ones subcapitate, without petals ± 8–11 mm diam, the pilosulous axis (0.5) 1–3 cm long; *bracts* persistent, rhombic-ovate-apiculate to lanceolate and shortly acuminate, 2–3 mm long, livid and gland-verruculose dorsally beneath the pilosulous vesture, silky-pilosulous within; *calyx* 4.6–6 mm long, densely pilosulous externally and internally about the orifice, the rather firm tube 2.5–3 mm long, bluntly ribbed, the ribs brown, the pale intervals charged with 1–2 irregular rows of minute yellowish glands visible only from within, the subulate-acuminate, gland-denticulate teeth somewhat unequal, the dorsal one 1.9–3 mm long,

as long or more often shorter than the tube, the ventral pair slightly shorter and broader; *petals* bicolored, the banner opening whitish with purple-tipped basal lobes, rubescent in age, the inner petals bright purple, inserted at 1.2–1.7 mm from the hypanthium-rim, the banner and keel gland-tipped, the banner-blade gland-sprinkled; *banner* 5.4–6.8 mm long, the deltate-ovate or spade-shaped blade 3.5–4 mm long, about as wide, hooded at apex, closed across top of claw to form a shallowly recessed cornet; *wings* 6.4–7.3 mm long, the claw 2–2.8 mm, the lance-oblong blade 4.4–4.8 mm long, ± 1.8 mm wide; *keel* 8.4–10 mm long, the claws 3–3.9 mm, the broadly oval-obovate to elliptic blades 5.5–6.2 mm long, 2.9–3.5 mm wide; *androecium* 10-merous, 7–9.5 mm long, the longest filament free for 2.6–3 mm, the bluish, gland-tipped anthers ± 0.6 mm long. — Collections: 4 (o).

Habitat not recorded, but to be sought on dry hillsides and gullied banks at ± 2400–2500 m, known only from Valley of Mexico in Estado de México and adjoining Hidalgo. — Flowering July and August. — *Material*: HIDALGO: Tulancingo, typus (cf. infra); *Moore & Wood 4878* (BH, NY); *Purpus 1377* (NY, p. p., mixed with *D. bicolor*). MÉXICO: Amecameca, *Purpus 1743* (F, UC).

Dalea aenigma (a riddle, the status and affinity obscure) Barneby, Phytologia **26**: 1. 1973. — "MEXICO. Hidalgo: Tulancingo, July 22, 1905, *Rose, Painter & Rose 8832...*" — Holotypus, NY! isotypi, F, GH, US!

A small suffruticulose dalea, in habit suggesting *Astragalus danicus* L., *D. aenigma* falls within a circle of affinities dominated by protean *D. bicolor,* from which it is precariously separable by a syndrome of individually inconsiderable characters. The short procumbent stems, rooting where they touch the ground, are reminiscent of *D. greggii* rather than *D. bicolor*, but the foliage cannot be reconciled with what is known of *D. greggii*, the 4–7 (not 2–4) pairs of ventrally glabrous leaflets being abruptly different. Stems of *D. bicolor* var. *bicolor*, normally a much taller, shrubby or arborescent plant with lax and elongate spikes rising 5 dm or much more above the root, are nevertheless prostrate in one rare form, that described by Schlechtendahl as *D. thymoides*. This, however, still differs from *D. aenigma* in its spike at once short-pedunculate and lax of very short-toothed and shortly pilosulous calyces. The banner of all forms of *D. bicolor* known to date from the high plains of Hidalgo and adjoining states is glandless except for an occasional, always minute, terminal blister; in *D. aenigma* the blade's eye is charged with a conspicuous gland-crescent. A Purpus collection (*no. 1377*, NY) of *D. aenigma*, made at Tulancingo on the same day as the type-set, probably therefore an exact topotypus, is mixed with genuine *D. bicolor* var. *bicolor* in a phase similar to that collected often near Pachuca and vicinity. This suggests that *D. bicolor* and *D. aenigma* are sympatric, and strengthens the latter's claim to recognition.

The riddle of *D. aenigma* has another facet. A hypothetical plant of the species shorn of vesture except for pubescent axillary short-shoots and with calyx-pubescence proportionately thinner and shorter would become essentially like the plant treated next in order as *D. macrotropis*, a point that can be appreciated by comparison of the two figures on Plate CIV. Such glabrate phases are commonplace among kindred daleas. However the stem of *D. macrotropis* is not known to be radicant and the source of the type remains a mystery. Pending rediscovery of *D. macrotropis* and study of new populations of *D. aenigma* it seems desirable to provide the latter with a name and, if only provisionally, specific status.

113. DALEA MACROTROPIS Schauer
(Plate CIV)

Apparently suffruticose and diffuse, the slender, procumbent, arching but not (?) radicant stems at least 3 dm long (full stature unknown), livid-castaneous, glabrous,

prominently verruculose, the foliage dimorphic, the primary cauline leaves glabrous, with thick-textured, glaucescent, dorsally dotted leaflets, these subtending ± densely puberulent short-shoots composed of smaller crowded leaves densely pilosulous-tomentulose with spreading hairs up to 0.4 mm long; *leaf-spurs* 0.5–0.7 mm long; *stipules* slenderly subulate, 1–1.4 mm long, livid, glabrous; *intrapetiolular glands* small, prominent; *post-petiolular glands* mammiform; *leaves* short-petioled, the primary cauline ones 12–16 mm long, with narrowly margined, punctate rachis and 5–8 pairs of oblong-oblanceolate to narrowly obovate, emarginate, dorsally keeled, loosely folded leaflets 2.5–5 mm long, the leaves of short-shoots smaller, with 3–5 pairs of shorter leaflets; *peduncles* terminal to main stem and branches, 2–4 cm long, puberulent under the spike; *bracts* deciduous, ovate-acuminate, livid, ± 3 mm long, flat, the lowest glabrous or nearly so dorsally, the interfloral ones pubescent at base dorsally, glabrous distally, all silky within; *calyx* 4.8 mm long, thinly pilosulous with ascending hairs up to ± 0.35 mm long, the tube 2.6 mm long, not recessed behind banner, the orifice subsymmetrical, the ribs castaneous, becoming prominent, the membranous intervals charged with 1 row of ± 4 small glands, the subulate teeth a little unequal, the dorsal one 2.2 mm long, the ventral pair a little shorter and broader, none gland-spurred; *petals* bicolored, the banner whitish or yellowish on opening, the epistemonous ones perched 0.6–1.4 mm above hypanthium rim, rose-purple, none gland-tipped but the banner charged in eye of blade with a few tiny glands; *banner* 6.5 mm long, the claw 3.3 mm, the deltate-cordate, hooded blade open at base, ± 3.5 mm wide and long; *wings* 6.3 mm long, the claw 2.5 mm, the oblong-obovate blade 4.4 mm long, 1.9 mm wide; *keel* 9 mm long, the claws 4.1 mm, the broadly ovate-elliptic blades 5.5 mm long, 3.1 mm wide; *androecium* ± 8 mm long, the connective gland-tipped, the anthers 0.5–0.55 mm long. — Collections 1 (o).

Range and habitat unknown, the description based on the following specimen: "Mexico, *Aschenborn, Schumann*", the ticket with figure "43" in lower left corner and stamped "Mexico leg. *Schmitz*.", W (herb. Rchb. f., *no. 125116*).

Dalea macrotropis (with large keel) Schauer, Linnaea **20**: 742. 1847. — "In montanis Oaxacanis. *Aschenb*[*orn*] n. 311." — Holotypus, presumably destroyed at B; no isotypus found, v. discussion below.

The description of *D. macrotropis* has been prepared from a fragmentary but unique specimen, the only one examined that agrees in almost all points with the protologue. Schauer's description is admirably detailed and includes measurements of leaves, leaflets, calyx, and keel-blades, all agreeing with the plant at Vienna. The most unusual characteristic of Schauer's plant was the distribution of the vesture: "glabra, solis innovationibus sericeo-villosis." This phrase aptly describes the densely silky axillary short-shoots that arise from glabrous stems and are subtended by glabrous primary foliage. The only discrepancy between description and plant is a slight and unimportant one; according to Schauer the leaflets should be 7–10 pairs; in the specimen seen they are 5–8 pairs.

Interpretation of the label is difficult. The handwriting is unknown to me and it is not clear whether the plant was collected by Schmitz (as stamped) or by Aschenborn (or Schumann) as given by what seems to have been the original ticket. It is not possible to link the specimen securely with *Aschenborn 311*, the lost holotypus of *D. macrotropis*, but its characters suggest that it is indeed an isotype. No modern collection in American herbaria matches it and if this is not Schauer's plant it must represent an undescribed entity.

I speak of *D. macrotropis* as an undescribed entity rather than in terms of a distinct species, for this is not securely demonstrated by the scanty material available. Under the title of *D. aenigma*, immediately foregoing, I have described a plant from the plateau north and east of Mexico City which seems closely related to *D. macrotropis*, but has all foliage like the stems equably pilosulous, a much more densely pubescent calyx, and bracts of

different shape. These differences might well dwindle into insignificance if we had more extensive material. The only Mexican dalea characterized by glabrous primary leaves subtending gray-villous short-shoots is *D. hemsleyana*, an erect shrublet with extremely compact and hard conelike spikes, differing further in small details of interfloral bracts and a glandless banner. The Vienna specimen does not fit easily into my concept of this species, but I suspect they are close allies. In the circumstances *D. macrotropis* remains as a shadowy concept, its name and status contingent on discovery of an authentic piece of *Aschenborn 311* in some herbarium and a matching population somewhere in highland Mexico.

114. DALEA HEMSLEYANA (Rose) Bullock
(Plate CV)

Suffruticose becoming shrubby, many-stemmed, the mature plant of symmetrically bushy outline ± 3.5–7 dm tall and as broad or broader, at anthesis appearing glabrous to the spikes but the truly glabrous (or distally puberulent) main cauline leaves subtending silvery-pubescent leaf-buds (by late anthesis becoming short spurs), the old wood brown and furrowed, the young stems livid, freely branching, densely verrucose with small but prominent, often grainlike, lurid or pallid warts, the young foliage sparse, green, the leaflets of thick texture, paler and dotted beneath; *leaf-spurs* 0.4–1 (1.5) mm long; *stipules* triangular-subulate, livid, 0.3–1.2 mm long; *intrapetiolular glands* small, either impressed or prominent; *post-petiolular glands* nipple-shaped or conic, greenish or livid; *main cauline leaves* mostly 4–14 (20) mm long, subsessile, with narrowly thick-margined, ventrally grooved rachis and 4–7 (8) pairs of usually crowded, obovate-cuneate to oblanceolate, emarginate or retuse, folded leaflets 1–3 (4) mm long, the spur-leaves, when developed, smaller, with fewer smaller leaflets of the same type; *peduncles* leaf-opposed and then terminal to all the branchlets, 2–12 cm long; *spikes* very dense and conelike, globose or broadly ovoid, without petals 7–10.5 (12) mm diam, the densely villosulous axis 2–14 mm long; *bracts* 2–3.5 mm long, dimorphic, the outer ones persistent, broadly ovate to elliptic-ovate, livid, glabrous or nearly so and gland-verruculose dorsally, ciliolate, the inner ones tardily deciduous (half fast between the crowded calyces) oblanceolate, densely pilosulous dorsally in lower half, glabrate and livid distally, all silky within above the middle; *calyx* 3.4–5.4 mm long, densely pilosulous externally with spreading-ascending spiral hairs up to 0.45–0.65 mm long, the tube 2–2.8 mm long, sometimes but not always recessed behind the banner, the ribs becoming prominent, orange-brown, the intervals membranous, eglandular or charged with 1–3 minute, transparent glands visible only from within, the triangular-acuminate, livid or nigrescent, gland-spurred teeth usually a little unequal, the dorsal one 1.3–2.7 mm long (as long or commonly shorter than the tube), the ventral pair shorter but hardly broader; *petals* bicolored, the banner opening cream-white (sometimes purple-tipped), rubescent, the inner ones vivid rose- or magenta-purple, all eglandular, the wings and keel elevated 1.1–1.5 mm above the hypanthium rim; *banner* 4.7–6.4 (7) mm long, the claw 2–2.9 (3.4) mm, the deltate-ovate blade cordate at the open base, reflexed through ± 40°, 2.5–4.3 mm long, 2.4–4.8 mm wide; *wings* 4.5–7.2 mm long, the claw 1.5–2.2 mm, the ovate-elliptic to lance-oblong blade 3.3–5.6 mm long, 1.2–2.4 mm wide; *keel* 5.3–8 mm long, the claws 2.2–3.1 mm, the broadly ovate-elliptic blades 3.5–5.4 mm long, 2.1–2.8 mm wide; *androecium* 5.5–8.5 mm long, the longest filament free for 2.1–2.8 mm, the gland-tipped anthers 0.7–0.8 mm long; *pod* (not seen fully formed) ± 2.5 mm long, apparently deltate in profile, the style-base terminal but excentric, the valves glabrous and

hyaline in the lower half, thinly papery and densely pilosulous distally; n = 7 (Spellenberg, 1973). – Collections: 9 (iv).

Colonial along gullies and on open plains in arid grassland, 2100–2450 m (± 7000–8150 ft), known only from s. Zacatecas and w. San Luis Potosí, but closely approaching and to be expected in Aguas Calientes, extreme n.-e. Jalisco, and s.-e. Durango. – Flowering August to November. – *Material*: San Luis Potosí. "San Luis", *Schaffner 586/785* (M, MEXU, NY, US); 25 mi s.-w. of San Luis, *Ripley & Barneby 13,326* (CAS, MEXU, MICH, NY, US). Zacatecas. 5 mi w. of Zacatecas, *Spellenberg & Dunford 2940* (NY); s. corner of the state, n.-e. of Ojuelos de Jalisco, *Ripley & Barneby 13,330* (CAS, MEXU, MICH, K, NY, US); Malpaso, 16 mi s.-w. of Zacatecas, *Ripley & Barneby 13,456* (CAS, MEXU, MICH, NY, US); Zacatecas, *Purpus 419* (UC); Fresnillo (vidi!); pass through Sierra Papantón, border of Durango, *Gentry 8450* (MEXU, UC, US); ibid., near El Calabazal, *Ripley & Barneby 14,156* (CAS, MEXU, NY, US).

Dalea hemsleyana (Rose) Bullock, Kew Bull. **1939**: 196. 1939, based on *Parosela hemsleyana* (William Botting Hemsley, 1843–1924) Rose, Contrib. U. S. Nat. Herb. **10**: 104. 1906. – "Type...collected by Parry and Palmer near San Luis Potosí, 1878 (no. 154)." – Holotypus, US! isotypi, F, NY (2 sheets), US! – *Dalea ramosissima* sensu Hemsl., Biol. Centr.-Amer., Bot. **1**: 245, non Benth.

On the steppes and desert grasslands of Mexico's Meseta Central, southward from the Tropic, only two daleas, *D. hemsleyana* and *D. dorycnioides*, share the features of densely warted stems and subglobose conelike flower-spikes subtended by persistent bracts. Mature plants of both species form small, intricately branching bushes, with the condensed foliage of the confirmed xerophyte, and in due season very numerous and showy heads of flower. In *D. dorycnioides* the stems of the year and all the leaves are gray- or white-tomentulose, and even in the largest leaves the leaflets are normally only 2–4 pairs; in *D. hemsleyana* the young stems are glabrous like the main cauline leaves, which are composed of mostly 4–7 pairs of leaflets. Furthermore the two species are ecologically separated, as *D. dorycnioides* is strongly, perhaps obligately calciphile, and therefore follows the limestones of the Sierra Madre Oriental from Nuevo León southward, while *D. hemsleyana* is on the old eruptive rocks that form the backbone of Zacatecas. They are therefore, despite similar flowers and inflorescences, easily separated in practice. But although the plant-body of *D. hemsleyana* is, at least up to anthesis, glabrous or nearly so, late in the season densely silvery-tomentulose leaf-buds appear in the axils of the drought-deciduous primary foliage. These buds, very similar to axillary buds in *D. dorycnioides*, may either remain permanently inhibited or grow out into small, gray-pubescent, leafy spurs serving to carry on a limited photosynthesis during the dry winter months. At this stage, *D. hemsleyana* becomes uncomfortably close to *D. dorycnioides*, of which it may be no more than a well marked geographic variant in which a seasonal but incomplete loss of pubescence has accompanied a slight increase in leaflet-number synchronized with adaptation to soils poor in lime.

Immediately to the south and east of its range *D. hemsleyana* is replaced in similar habitats by the similarly glabrous, small-leaved, densely tuberculate *D. minutifolia*. When flowers are present this is easily distinguished by the relatively loose spike, deciduous bracts, and prominently gland-sprinkled or gland-tipped petals. The two species are contrasted further on Plate CV. The only genuinely sympatric close relative of *D. hemsleyana* is *D. bicolor* var. *bicolor*, variable in vesture and foliage but consistently different in its long, tapering, loosely flowered spikes.

The type-collection of *D. hemsleyana* is attributed to Parry and Palmer, but it flowers so late in the year that it must have been taken by Palmer alone, after Dr. Parry had returned to the United States (see McVaugh's Life of Edward Palmer, p. 78). Schaffner's

specimens, collected the same year, are so much like the type, that one is tempted to think they were collected from the same population and on the same day. The isotype at Kew was referred by Hemsley to the then poorly known Baja Californian *D. ramosissima* Benth (our *D. brandegei*), which has similarly warty stems but a loose spike and deciduous bracts. When Rose noticed the mistake he dedicated *Parosela hemsleyana* to the Kew botanist, but explicitly cited the duplicate at US as typus.

115. Dalea minutifolia (Rydberg) Harms

(Plate CV)

Slender but wiry, closely branching, erect or less often diffuse and straggling shrubs up to 1 m tall, the stramineous or purplish young stems densely verruculose, either glabrous to the inflorescence or the growing tips, or the leaf-stalks, or the leaflets, or some of these, thinly puberulent with short spreading hairs, the small but numerous (drought-deciduous) leaves green, the thick-textured leaflets smooth above, punctate and sometimes glaucescent beneath; *leaf-spurs* 0.3–0.6 mm long; *stipules* narrowly triangular or subulate, castaneous or livid, 0.8–1.8 mm long; *intrapetiolular glands* 0; *post-petiolular glands* large, conic or mammiform; *leaves* (2) 3–9 (12) mm long, short-petioled, with 2–4 (5) crowded pairs of obovate, obovate-cuneate, or broadly oblanceolate, retuse or emarginate, mostly folded and backwardly arched leaflets 1–3 mm long; *peduncles* all or almost all terminal to leafy spurs or branchlets, mostly very short or obsolete, a few of the earliest up to 12 (25) mm long; *spikes* moderately dense, few-flowered, ovoid-conic becoming ovoid, subglobose, or shortly oblong, without petals or androecia 6–8.5 mm diam, the densely villosulous axis 2–15 (30) mm long; *bracts* promptly deciduous, ovate or lance-acuminate, firm, purplish or livid, prominently gland-pustulate, dorsally pilosulous or the lowest glabrous, glabrous within; *calyx* 3.1–4.4 (4.7) mm long, densely pilosulous with fine spreading hairs up to 0.4–0.8 mm long, the tube 2.1–2.7 mm long, a trifle recessed behind banner and the orifice oblique, the orange or castaneous, distally livid ribs becoming prominent, the intervals charged with 1 sometimes irregular row of ± 4–6 golden or orange glands, the deltate- or triangular-apiculate or -cuspidate, gland-spurred teeth somewhat unequal, the dorsal one 1–1.8 (2.2) mm long, ± ½–⅔ as long as tube; *petals* bicolored, the banner opening yellowish, rubescent, the epistemonous ones purple, perched well below middle of androecium, all charged with a large, linear-elliptic gland below the apex; *banner* 4–5.3 (6) mm long, the claw 1.5–2.6 (3) mm, the deltate-cordate blade 2.8–3.5 mm long, 3.2–4.8 mm wide, recessed at base into a shallow cornet; *wings* 4–6 mm long, the claw 0.8–1.6 mm, the broadly lance-oblong blades 3.4–4.8 mm long, 1.9–2.5 mm wide; *keel* 4.5–7.5 (8) mm long, the claws 1.3–2.8 (3) mm, the obliquely obovate blades 3.5–5 (5.4) mm long, 2.3–2.9 (3.4) mm wide; *androecium* 10-merous, 5.5–7.4 (8) mm long, the longer filaments free for 1.7–2.7 (3) mm, the connective gland-tipped, the anthers 0.5–0.75 mm long; *pod* (little known) in profile subdeltate, ± 2.5 mm long, the style-base at corner, the filiform prow slightly convex, the valves hyaline in lower third, thence thinly papery, villosulous, and charged with a few large glands; *seed* ± 1.8 mm long. — Collections: 30 (ii).

Plains and hillsides, especially in exposed or barren places, becoming locally dominant in actively degenerating badlands and on the pumice sands in the foothills of Orizaba, ± 2100–2800 m, Valley or Mexico and adjoining plateau, e. through Tlaxcala to centr. and n. Puebla and adjoining Veracruz, and n. through Hidalgo an unknown distance into San Luis Potosí. — Flowering July to January — *Representative*: San Luis Potosí. ——: *Schaffner 587/786* (M, MEXU, NY); *Troll 541* (M). Hidalgo. Actopan: *Bonpland 4112* (P-HBK, P, herb. Bonpl.). Huasca: *Matuda 831*

(MEXU). Atotonilco El Grande: *Ripley & Barneby 13,623* (CAS, NY, US). Pachuca: *Rose & Painter 8788* (NY). Mineral del Monte: *Rzedowski 18,182* (ENCB). Tepeapulco: *Rzedowski 18,281* (ENCB). VERACRUZ. ——— : *Purpus 11,164* (F); *Mueller 513* (BR, NY). PUEBLA. Tlachichuca: *Galeotti 3433* (G, BR). Cd. Serdán: *Ripley & Barneby 14,744* (CAS, F, GH, MICH, MEXU, NY, UC, US). Esperanza: *Balls 4456* (GH, K, US), *4507* (UC, US). ——— : La Unión near Puebla, *Arsène 443* (GH, NY, US). TLAXCALA. ——— : Tlaxco, *Aguilar 8-A-11* (ENCB). MÉXICO (Edo). Huixquilucan: *Rzedowski 21,957* (ENCB). Texcoco: *Paray 1739* (ENCB). MÉXICO (D.F.): *Rzedowski 546* (ENCB); *Paray 1515* (ENCB).

Dalea minutifolia (Rydb.) Harms, Verhandl. Bot. Ver. Brandenb. **65**: 88. 1923, based on *Parosela minutifolia* (with minute leaflets) Rydb., N. Amer. Fl. **24**: 87. 1920. — "Type collected at Pachuca, Hidalgo, May, 1905, *Purpus 1145*..." — Holotypus, NY! isotypus, UC! — *Parosela polycephala* var. *minutifolia* (Rydb.) Macbr., Contrib. Gray Herb. New Ser. **65**: 18. 1922.

Parosela polycephala (with many spikes) Rydb., N. Amer. Fl. **24**: 90. 1920. — "Type collected in San Luis Potosi, 1878, *Parry & Palmer 160*..." — Holotypus, US (not seen); isotypi, K, NY, P! — *Dalea polycephala* (Rydb.) Bullock, Kew Bull. **1939**: 197. 1939.

A wiry undershrub of modest proportions, notable for the extreme xerophytic reduction of the foliage accompanied by high development of secretory vesicles almost throughout the plant body, the stems and undersurface of the little fleshy, folded leaflets being densely verruculose and each petal charged with a large subapical blister-gland. The relatively loose and few-flowered spikes of short-toothed calyces subtended by early deciduous bracts suffice to distinguish *D. minutifolia* from the equally xerophytic and heavily warted *D. hemsleyana*. These two species are allopatric as far as known for certain, but exact localities for *D. minutifolia* in San Luis Potosí are lacking.

While uniform in general appearance, *D. minutifolia* like many kindred daleas occurs in glabrous and thinly pubescent variants, recognized by Rydberg as coordinate species. In 1920 however, the pubescent phase was known (to Rydberg) only from San Luis Potosí and the glabrous one from Hidalgo southward, suggesting a geographic correlation which does not exist in fact. In reality the pubescent form had been collected already by Humboldt and Bonpland at Actopan, only a short distance from the type-locality, at Pachuca, of supposedly glabrous *D. minutifolia*, of which even the type series includes puberulent individual plants. The puberulent variant is apparently the commoner of the two, and has been traced south to the limit of the species in México and Distrito Federal. There is no longer any basis for maintaining two taxonomic categories, even at varietal level.

Here and there on the bleak pumice plains at the foot of Cofre de Perote and Orizaba the plants of *D. minutifolia* form extensive colonies, crowding together into sere thickets standing a foot or two tall, but becoming in the most exposed places depressed or trailing. In thin pine-juniper woodland near Perote occurs an ambiguous dalea (*Ripley & Barneby 14,748*, NY) that seems to combine features of *D. minutifolia* and *D. versicolor* var. *lasiostachya*. It might be described as a slender, unusually warty and small-leaved form of the latter, or as a form of *D. minutifolia* with enlarged leaves and exceptionally long-toothed, long-hairy calyx. No form of *D. versicolor* is known to occur near Perote, and the true nature of this interesting form remains to be determined.

The earliest known collection of *D. minutifolia* is preserved in the herbarium of Sessé & Mociño (*No. 2667bis*, F, MA), but cannot be connected successfully with any of the still unidentified names based on material dispersed out of the collection by Pavón.

A photograph of a Humboldt collection at Berlin, presumably a duplicate of those in Paris cited above, was distributed (*Field Neg. 726*) by Macbride as *Dalea microphylla* H. B. K., a Peruvian dalea quite different in detail although similar in the diminutive foliage. Cf. *D. carthagenensis* var. *brevis*.

During the preliminary studies I was under the mistaken impression that the correct name for the present species was *D. polycephala*, and used it in annotation of specimens. The epithet *polycephala* was applied to *Parry & Palmer 160* at K by Bentham and was listed by Hemsley (1880, p. 244) but remained unpublished until North American Flora (1920), where it appeared under *Parosela* at the same time as *P. minutifolia*. Neither has priority at this point. In *Parosela* Macbride in 1922 established priority for *polycephala* by reducing *minutifolia* to varietal rank under it. In *Dalea*, however, Harms established priority for *D. minutifolia*)1923) over the much later *D. polycephala* (Rydb.) Bullock (1939).

116. Dalea gypsophila Barneby
(Plate XCVII)

Dwarf subshrubs 1–2 (2.5) dm tall, glabrous to the flower-spikes, the older branches decumbent, adventitiously rooting, thereby forming diminutive thickets up to 1 m diam, the young flowering stems incurved-ascending and erect, densely leafy, simple or branched, densely tuberculate with small but prominent warts, the foliage green, the leaflets smooth above, beneath gland-tuberculate and also microscopically pallid-papillate; *leaf-spurs* less than 0.7 mm long; *intrapetiolular glands* 0–1; *post-petiolular glands* prominent, subulate or prickle-shaped; *leaves* shortly petioled, (5) 7–14 mm long, with very narrowly margined, tuberculate rachis and (4) 5–8 pairs of crowded, linear-oblong or -oblanceolate, emarginate but bluntly gland-mucronulate, thick-textured, folded leaflets 1.5–3.5 (4) mm long; *peduncles* terminal, mostly solitary, 1–2.5 cm long, the inflorescence projected well above the leaves; *spikes* loosely (6) 10–22-flowered, without petals 6–8 mm diam, the ascending flowers when pressed subcontiguous but mostly 2-ranked, the axis becoming (3) 6–25 (35) mm long; *bracts* tardily deciduous, broadly ovate or lance-ovate, (2.2) 2.5–3.5 mm long, greenish or livid becoming castaneous, glandular-tuberculate dorsally, the lowest glabrous or nearly so externally, ciliolate, the upper ones finely pilosulous below middle; *calyx* sessile, 4–4.6 (5) mm long, silky-pilosulous or loosely strigulose with ascending hairs up to 0.3–0.45 mm long, the tube 2.1–2.6 mm long, the ribs subfiliform, little prominent, the relatively firm intervals charged with 1 (the ventral pair with 2) rows of 3–7 small glands, the triangular-subulate, minutely gland-spurred teeth unequal, the dorsal one 1.1–1.9 (2.5) mm long, the ventral pair shorter and broader, the orifice ± oblique; *petals* bicolored, the banner opening creamy-yellow, often purple-edged, early rubescent, the epistemonous ones dark plum-purple, perched below middle of androecium (1.5–2.5 mm above hypanthium), all or all but the banner charged with a small subapical gland; *banner* 4.5–5.4 mm long, the claw 2.3–3 mm, the deltate-cordate or suborbicular emarginate blade recurved through ± 45°, recessed at base into a shallow cornet, 2.7–3.7 mm long, 2.8–4.2 mm wide; *wings* 3.5–6.3 mm long, the claw 1–1.6 mm, the oblong or lance-oblong blade 2.9–5 mm long, 1.4–2.5 mm wide; *keel* 5.2–6.6 (7.2) mm long, the claws 1.6–2.2 (2.4) mm, the broadly ovate-elliptic blades 3.8–4.7 (5.3) mm long, 2–3.2 mm wide; *androecium* 10-merous, 6.7–7.6 (8) mm long, the longer filaments free for 2.2–2.5 mm, the connective gland-tipped, the yellow anthers 0.65–0.8 mm long; *pod* in profile triangular-obovate, 2.2–2.6 mm long, the short style-base latero-terminal or nearly so, the sutures slender, the valves hyaline and glabrous in lower half, thence thinly papery, pilosulous, and charged with a few small glands; *seed* 2–2.3 mm long; 2n = 14 (Mosquin).—Collections: 9 (iii).

Valley flats and low gullied hills in thin pine-pinyon woodland, confined to gypseous clay soils, 1830–2070 m (6100–6900 ft), locally abundant near the watershed of Sierra Madre Oriental from Galeana s.-e. 60 km just into the n. edge of mpo Aramberri, lat. 24° 15′ to 24° 50′ N, in s.-centr. Nuevo León. — Flowering June to November. — *Representative*: NUEVO LEÓN: *C. & M. Mueller 1082* (F, GH, MICH); *Correll & Johnston 19,861* (RENNER); *G. N. Jones 22,914* (WIS); *Ripley & Barneby 13,792* (CAS, MEXU, MICH, NY, US), *14,775* (DAO, NY); *Shreve & Tinkham 9726* (ARIZ, GH, MICH).

Dalea gypsophila (addicted to gypsum) Barneby, sp. nov., inter congeneres omnes foliolis (glaberrimis) dorso dense minutim papillosis unica, a *D. capitata* Wats. petalis epistemoneis saturate livido-purpureis (nec flavis), a *D. radicanti* Wats. sympatrica sed verosimiliter minus affini caulibus elevatim verruculosis, racemo pleiantho, tubo calycino extus sericeo, foliolisque minus numerosis (4–8 nec 6–11-jugis) procul distans. — Fruticulosa infra spicas glaberrima humilis, caulibus vix 2.5 dm altis decumbentibus radicantibus; folia 7–14 mm longa, foliois (4) 5–8-jugis lineari-oblongis vel -oblanceolatis complanatis 1.5–4 mm longis carnosulis; spicae laxe 6–22-florae axis maturus (3) 6–35 mm longus; bracteae demum deciduae ovatae 2.2–3.5 mm longae; calycis sessilis dense sericei tubus 2.1–2.6 mm longus, dentes triangulari-subulati inter se inaequales, dorsalis longior 1.1–1.9 (2.5) mm longus; petala bicoloria, vexillo ochroleuco saepe purpureo-marginato mox rubescenti, epistemoneis livido-purpureis, carinae laminis 3.8–5.3 mm longis. — NUEVO LEÓN: 2½ mi (± 4 km) s. of Galeana, oct. 29, 1964, *Ripley & Barneby 13,577*. — Holotypus, NY; isotypi, CAS, ENCB, GH, K, MEXU, MICH, NY, UC, US, Z.

A localized and taxonomically isolated species of uncertain relationship, possibly allied to the yellow-flowered *D. capitata* found, also at least sometimes on gypsum, in the same region. Like some forms of the latter, the plants of *D. gypsophila* spread by means of adventitious roots arising from the lower side of decumbent woody branches, eventually forming continuous patches a meter or more across. The very small, crowded leaflets are seen under magnification to be densely papillate, a feature not encountered elsewhere in *Dalea*. The narrow spikes of silky-pilosulous calyces rise vertically well above the crowded foliage but are far from showy, only one or two flowers being open at one time and these neither large nor vivid. The banner opens yellowish but soon fades reddish, and the epistemonous petals are deep plum-purple or faded crimson, sometimes against the background of white gypseous clay appearing almost black.

South of Galeana *D. gypsophila* is associated with the almost equally local *D. radicans*, like it insofar as it also forms diffuse masses of procumbent twigs, although this achieved by procumbently arching stems that root at tip. It differs further in the remotely leafy stem, smooth (non-papillate) leaflets, and short raceme of distinctly but shortly pedicellate, externally glabrous or glabrescent calyces. In one place *D. gypsophila* was found growing within an extensive colony of *D. greggii*, another procumbent, tip-rooting shrublet, but very different in its gray-silky foliage, few leaflets, and denser ovoid spike of rose-purple flowers. Despite the ostensibly remote kinship between them, an apparent hybrid was found among them, a single patch, probably clonal in character (*Ripley & Barneby 14,776*), combining the vesture of *D. greggii* with the microtuberculate leaf-surface of *D. gypsophila*.

While several calciphile daleas occur on gypsum and some seem to prefer it, *D. gypsophila* is one of very few that is (so far as known) confined to it. It forms, in fact, a characteristic element of a specialized gypsophyte florule that includes *Notholaena bryopoda* Max., *Linum modestum* C. M. Rogers, *Polygala oedophylla* Blake, *Hesperozygis ciliolata* Epl. and *H. pusilla* Irving, and *Pectis bracteata* Wats.

117. DALEA CAPITATA Watson

(Plate CVI)

Slender, freely branching shrubs up to 4 (5) dm tall, with erect to tortuously diffuse and, if procumbent, adventitiously rooting stems, glabrous to the inflorescence or thinly puberulent distally, the old wood grayish-brown or whitish, furrowed, the young twigs sparsely to densely gland-verruculose, the foliage bright green or glaucescent, the thick-textured leaflets punctate beneath, sometimes also above; *leaf-spurs* 0.2–0.5 mm long; *stipules* narrowly subulate, stiff, persistent, 0.4–1.3 mm long, often charged at base with a gland; *intrapetiolular glands* small or obsolete; *post-petiolular glands* prominent, orange or pallid, conic; *leaves* shortly petioled, the cauline ones 6–16 mm long, with (5) 7–11 (13) obovate, obovate-cuneate, or oblanceolate, truncate-emarginate or retuse, usually folded and backwardly curved leaflets 1.5–5.5 mm long, the spur-leaves shorter, sometimes with only (3) 5–7 smaller leaflets; *peduncles* terminal to the main stems and to small leafy axillary branchlets, (0) 2–10 (16) mm long, often puberulent; *spikes* shortly oblong to capitate, moderately dense, (1) 2–20 (35)-flowered, the pilosulous axis 1–15 (22), exceptionally up to 50 mm long; *bracts* persistent or very tardily deciduous, broadly ovate, acute to short-acuminate, clasping the calyx, (2.5) 3–5 mm long, firm, livid-castaneous or purplish-glaucescent, at least the lowest glabrous dorsally, the upper ones sometimes thinly pilosulous at base and tip, ciliolate or not, dorsally glandular or gland-verruculose, commonly silky-pilose internally at least above middle; *calyx* (3) 3.3–6.3 mm long, the tube (2) 2.2–4 mm long, externally either silky-pilosulous or rarely glabrous, the ribs slender, not very prominent, the intervals pale but firm, usually charged with 1 row of 3–5 small honey-colored glands, the subulate teeth densely pilosulous at least internally, unequal, the dorsal one longest, (1) 1.4–2.5 (2.9) mm long (0.5–2.5 mm shorter than tube), the ventral pair sometimes united behind banner into a shortly 2-dentate lip; *petals* pale yellow, in age rubescent or orange-brown, glandless or the keel and banner charged with subapical glands, the banner often gland-sprinkled, the epistemonous ones perched below middle of androecium, 1.3–3.1 mm above hypanthium; *banner* 3.5–6.2 (7) mm long, the claw 1.9–3.2 (3.5) mm, the deltate-ovate, ± hooded blade recessed at base into a shallow cornet, 2.3–4.4 mm long, 2.6–4.4 (4.8) mm wide, recurved through ± 40° from vertical; *wings* 3.1–6 mm long, the claw 0.8–1.7 mm, the oblong-ovate blade (2.7) 3–4.8 mm long, 1.5–2.6 mm wide; *keel* (3.7) 5.5-7.8 (8.1) mm long, the claws (1) 1.6-2.8 (3) mm long, the obovate-elliptic blades (3) 4–5.6 mm long, (2.1) 2.5–3.4 mm wide; *androecium* 10-merous, (5) 5.5–9.4 mm long, the longer filaments free for 1.8–3.5 mm, the anthers 0.6–0.8 mm long; *pod* (little known) ± 2.6–3 mm long, the style-base latero-terminal, the sutures slender, the valves membranous in lower ½–¾, thence thinly herbaceous, pilosulous, gland-sprinkled; *seed* not seen.

A perplexingly variable or rather polymorphic species, the disjunct populations differing in size of bract and flower, in relative proportions and vesture of calyx-tube and -teeth, in number of flowers to the raceme, and in hue of foliage. So little is known at present of the real dispersal and ecology of the variants that discrimination between races, and evaluation of their status, cannot be very convincing, but some are so well marked that they require formal recognition. Tentatively and provisionally four varieties are recognized here. Existence of a fifth, still insufficiently known, is mentioned under var. *capitata*.

Key to the Varieties of *Dalea capitata*

1. Ventral (adaxial) pair of calyx-teeth free from one another, the sinus between them not (or scarcely) shallower than the lateral sinuses.
   2. Spikes (4) 6–20 (36)-flowered, the longest on a plant obviously spiciform rather than capitate; *bracts* 2.5–4 mm long, green or castaneous, not glaucous, grossly tuberculate dorsally and ciliolate distally; *calyx-tube* 2.3–3.1 mm long; *leaflets* green and usually not punctate above; relatively widespread over desert and grassland w. of Sierra Madre proper in s. Coahuila to centr. Zacatecas, n. San Luis Potosí, and immediately adjoining Nuevo León; calciphile. 117a. var. *capitata*.
   2. Spikes subcapitately 1–5-flowered; *bracts* 4.5–5 mm long, plum-purple, glabrous and glandular dorsally, but the glands immersed or nearly so, thus not or scarcely tuberculate, not ciliolate; *calyx-tube* 3.4–3.7 mm long; *leaflets* punctate both sides; known only from the basin between Sierra de Guadalcázar and Sierra Madre in s.-e. San Luis Potosí; probably gypsophile. 117b. var. *quinqueflora*.

1. Ventral pair of calyx-teeth united behind banner into a spathaceous, shortly 2-dentate lip, the sinus between them much shallower than the lateral sinuses. Racemes and bracts of var. *capitata*; *calyx-tube* 3–4 mm long; *leaflets* punctate both sides; local in intermontane valleys of Sierra Madre Oriental; calciphile.
   3. Calyx silky-pilosulous externally from base upward; s.-centr. Nuevo León (betw. Galeana and Iturbide). 117c. var. *lupinocalyx*.
   3. Calyx glabrous externally, the orifice silky-villosulous; s.-w. Tamaulipas (Miquihuana). 117d. var. *pseudo-hospes*.

117a. Dalea capitata Watson var. capitata

(Plate CVI)

Young branchlets either glabrous or puberulent; *foliage* bright yellow-green or glaucescent, the mostly folded leaflets 1–3.5 (5.5) mm long; *spikes* (4) 6–20 (35)-flowered, the axis finally 3–25 (35) mm long. — Collections: 20 (iv).

Open rocky hills in desert-grassland transition, perhaps entering the lower edge of pinyon or pinyon-pine forest, 1680–2350 m (5600–7830 ft), local but forming colonies, s. Coahuila (mpos Parras and Saltillo) and adjacent Durango (mpo Pedro del Gallo-Ciudad Lerdo) to n. and n.-w. Zacatecas (mpos Melchor Ocampo, Concepción, Mazapil, Saín Alto) and n. San Luis Potosí (mpo Charcas), e. to the w. piedmont of Sierra Madre Oriental in extreme s.-w. Nuevo León (mpo Aramberri). — Flowering (March) April to October, following rains. — *Representative*: Durango: *M. C. Johnston et al. 11,461a* (TEX). Coahuila: *Purpus 4667* (F, UC); *Shreve 8560* (ARIZ); *Correll & Johnston 21,338* (RENNER); *Ripley & Barneby 14,143* (CAS, MEXU, NY, US), *14,512* (NY); *Shreve 9386* (ARIZ, UC); *M. C. Johnston 2962* (TEX); *Gentry 8553* (MEXU, MICH, UC). Nuevo León: *Shreve & Tinkham 9689* (ARIZ). San Luis Potosí: *Rzedowski 6592* (ENCB).

Dalea capitata (headlike, of the spikes, seldom appropriate) Wats., Proc. Amer. Acad. **25**: 146. 1890. — "At Carneros Pass, Coahuila [acc. Davis, 1936, p. 66, "in pine woods east of the station a mile or two"]; September [5], 1889 (n. 2378)." — Holotypus, GH! isotypi, BR, M, MEXU, NY (2 sheets), SD, UC, US, W! — *Parosela capitata* (Wats.) Rose, Contrib. U. S. Nat. Herb. **12**: 272. 1909.

Parosela lloydii (Francis Ernest Lloyd, 1867–1947) Rydb., N. Amer. Fl. **24**: 84. 1920 ("*Lloydii*"). — "Type collected at Cedros, Zacatecas, April 29, 1908, *Lloyd 60...*" — Holotypus, US! isotypus, UC! — *Dalea lloydii* (Rydb.) Gentry, Madroño **10**: 250. 1950.

A neat little shrub, becoming gnarled and woody at base, the decumbent branches sometimes rooting where they touch the ground, thereby forming miniature thickets. Only depauperate inflorescences borne on lateral spurs during the dry season can properly be described as capitate, the majority being obviously spiciform, especially in fruit. The young twigs vary from glabrous to puberulent, sometimes in the same locality. I collected both at Carneros Pass, and the glabrous form grows at Concepción del Oro, in the same range as Cedros, type-locality of *Parosela lloydii*. The only differential character assigned to the latter being a pubescent stem, it can be reduced to synonymy without regrets. A more distinguished variant, probably representing a taxonomically significant form, was collected by Rzedowski (*no. 6472*, ENCB) at 1600 m on the road from San Luis Potosi to Antiguo Morelos (near km 112, in mpo Guadalcázar). The specimens, collected in November, are depauperate, but silky-pilosulous throughout, in this different from all named forms of *D. capitata*. Spikes (probably starveling) 3–4-flowered, short but not capitate; leaflets 3–7, mostly 5, up to 2.5 mm long, pubescent both sides; bracts ± 2.5 mm long, pilosulous dorsally; calyx 5 mm, the tube ± 2.5 mm long, the dorsal tooth as long. The locality is only about 50 km n.-w. of the type-station of *D. capitata* var. *quinqueflora*, but the plant is different in many details.

117b. Dalea capitata Watson var. quinqueflora (T. Brandegee) Barneby (Plate CVI)

Branchlets glabrous; *foliage* glaucescent, the oblanceolate, folded leaflets up to 4.5 mm long, prominently punctate both sides; *spikes* (apparently even when most vigorous) subcapitately 1–5-flowered; *petals* gland-tipped, the keel-blades 4.3–5.2 mm long; *androecium* ± 8 mm long. — Collections: 2 (o).

Habitat not recorded, possibly on gypsum prevalent in the region, below 1500 m, known only from the interior basin lying between Sierra de Guadalcázar and Sierra Madre Oriental in mpos Guadalcázar, Ciudad del Maíz, and probably adjoining Cerritos, in s.-e. San Luis Potosí. — Flowering July to October. — *Material*: San Luis Potosí. Ciudad del Maíz: Minas de San Rafael, *Purpus 5269* (F, NY, UC, US). Guadalcázar: typus.

Dalea capitata Wats. var. **quinqueflora** (T. Brandg.) Barneby, stat. nov., based on *Dalea quinqueflora* (5-flowered) T. Brandg., Univ. Calif. Pub. Bot. **4**: 180. 1911. — "Collected at Buena Vista, San Luis Potosi, [C. A. Purpus] No. 4837..." — Holotypus, collected in November, 1910, UC! isotypi, GH, US! — *Parosela quinqueflora* (T. Brandg.) Rydb., N. Amer. Fl. **24**: 84. 1920.

The accompanying figures emphasize, with greater force and immediacy than words could do, the similarities and differences between the various forms here subordinated to *D. capitata*. Few flowers subtended by relatively ample, feebly verruculose bracts combined with foliage perfectly glabrous and more glaucous than that of its immediate kindred are the chief marks of var. *quinqueflora*. More material, showing the vernal as well as the autumnal aspect of the plants, and data on habitat are needed before the status of the entity can be considered settled. Rydberg (1920, p. 69, in key) mentions a difference in pubescence of the calyx, the hairs of *quinqueflora* being supposedly more appressed than in the aspect of *D. capitata* there called *Parosela lloydii*, but it is not confirmed in the more extensive material now available.

117c. DALEA CAPITATA Watson var. LUPINOCALYX Barneby
(Plate CVI)

Branchlets glabrous; *foliage* bright green, the leaflets up to 5.5 mm long, punctate above and beneath; *spikes* 7–25-flowered; *petals* glandless, the keel-blades 5.1–5.6 mm long, 3–3.4 mm wide; *androecium* 8.3–9.4 mm long. — Collections: 3 (ii).

Dry sunny hillsides in the pine-oak belt, 1500–1820 m (5000–6050 ft), local but forming extensive and colorful colonies near but e. of the crest of Sierra Madre Oriental between Galeana and Iturbide, s.-e. Nuevo León. — Flowering August to December. — *Material*: NUEVO LEÓN. Galeana: 10 mi from Galeana on road to Iturbide, *Graham & Johnston 4230* (MEXU, MICH, TEX); approximate topotypes, *Ripley & Barneby 14,778* (ARIZ, CAS, DAO, GH, IA, K, MEXU, MICH, UC, US).

Dalea capitata Wats. var. **lupinocalyx** (with calyx of *Lupinus*, the two adaxial teeth united) Barneby, var. nov., a var. *capitata* praesertim dentibus calycinis ventralibus inter se longe coadunatis, superiori calycis labio ideo spathaceo brevissime bidentato absimilis. Flores insuper majusculi, foliola majuscula laete viridia, petala apice eglandulosa notulas minus graves forsan haud diagnosticas offerrunt. A var. *pseudo-hospite* Barneby quoad calycis formam praesimili tubo calycino extus (ut apud var. *capitatam*) ex ipso basi undique sericeo-pilosulo abstat. — NUEVO LEÓN. Galeana: Sierra Madre Oriental e. of Pto Los Encinos, Oct 29, 1964, *Ripley & Barneby 13,573*. — Holotypus, NY; isotypi, CAS, MEXU, US.

This variety and the next, each known only from one restricted area high on the east side of the Sierra Madre crest, differ collectively from the two foregoing in the modified calyx, of which the two upper teeth are united for half their length or more into a single apically bidentate lobe. More collections from the Sierra may well show that var. *lupinocalyx* and var. *pseudo-hospes* are merely pubescence-variants of one more variable entity, but there is no evidence as yet on the point. The calyx of var. *lupinocalyx* resembles that of var. *capitata* in pubescence but is longer, as is the androecium. The glandless petals are not yet duplicated in the species.

Compared with var. *capitata*, the present plant is a showy one, laying down over the limestone gravel hillsides and along stony washes a carpet of foliage, at first bright green, in fall turning golden-yellow under the mass of flower. Decumbent branches around the edge of each clump root freely where they touch the soil, and it seems likely that some of the larger, now discontinuous patches may be made up of severed parts of a single aged clone.

117d. DALEA CAPITATA Watson var. PSEUDO- HOSPES Barneby
(Plate CVI)

Branchlets glabrous; *foliage* yellow-green, the leaflets up to 4 mm long, punctate both sides; *spikes* 5–12-flowered, the axis elongating; *petals* gland-tipped, the keel ± 7.3 mm, its blades 5 mm long, 2.6 mm wide; *androecium* ± 8 mm long. — Collections: 1 (typus).

On limestone gravel, ± 1920 m (6400 ft), known only from the s. foothills of Cerro Peña Nevada in Sierra Madre Oriental, near Miquihuana, s.-w. Tamaulipas. — Flowering in July, probably into fall.

Dalea capitata Wats. var. **pseudo-hospes** (simulating and mistaken for *D. hospes*) Barneby, var. nov., calycis labio superiori var. *lupinocalyci* similis sed tubo extus ad orem

ciliolatum usque glaberrimo petalisque glandula subapicali praeditis aberrans. A var. *capitata* et var. *quinqueflora* praeter calycis formam alienam differt: a priori tubo calycino androecioque longioribus, foliolis superne punctatis, a secunda floribus compluribus spicatis nec paucis subumbellatis necnon bracteis parvulis. — TAMAULIPAS. Miquihuana: on decomposed limestone at base of hills, near reservoir of Miquihuana, July 10, 1949, *Stanford, Lauber & Taylor 2388.* — Holotypus, US; isotypus, UC.

A little shrub, up to 4.5 dm tall, with lemon yellow flowers. The type was distributed as *D. hospes*, often similar in the externally glabrous calyx and yellow petals, but very different in habit and in the pedicellate flowers. The variety suggests var. *quinqueflora* in foliage, var. *capitata* in the spike, and var. *lupinocalyx* in the spathaceous calyx, but is distinguished from all by the glabrous calyx-tube.

IVC (xvii). Series PULCHELLAE Barneby

Perennial herbs suffrutescent in age, sometimes flowering the first season, glabrous to the spikes, the slender, wiry stems densely and prominently verruculose; *leaflets* 7–14 pairs, distantly inserted along rachis, small, obovate to obcordate, the lowest pair largest and inserted at base of leaf-stalk next to the pulvinus; *spikes* dense, cone-like; *bracts* tardily deciduous, glabrous within; *calyx* densely pilose, its tube shallowly recessed behind banner, shorter than longest tooth, the intercostal membranes charged with 1 row of minute glands; *epistemonous petals* purple or violet, low-perching, the keel-blades ± 3.5 mm long. — Sp. 1, of the Pacific slope in Mexico (Sinaloa and adjacent Durango to w. Jalisco).

Dalea subgen. **Parosela** sect. **Parosela** ser. **Pulchellae** Barneby, ser. nov., verosimiliter ser. *Pectinatis* proximae, sed caulibus undique verrucosis, spica praedensa, bracteis interfloralibus subpersistentibus, tubi calycini glandulis minutis 1-seriatis, foliorumque forma peculiari (et ideo adspectu proprio) abstantes; a ser. *Tuberculatis* quoad caules eximie verruculosos comparandis et forsan propioribus praesertim foliolis multijugis eorumque jugo infimo majusculo quasi stipuliformi cito exclusae. — Sp. unica: **D. pulchella** G. Don.

118. DALEA PULCHELLA G. Don
(Plate CVII)

Herbaceous becoming suffruticose in age, seedling plants capable of flowering the first season (as apparent annuals) when only 4 dm tall, but 1–1.6 m high at full maturity, glabrous below the silky spikes, the stems reddish, strongly gland-tuberculate, rather sparsely leafy, paniculately branching above the middle, the ultimate branchlets stiff but very slender, the foliage glaucescent, the thick-textured leaflets punctate both above and beneath; *leaf-spurs* up to 1 mm long; *stipules* minute, subulate, early dry and caducous, less than 1 mm long; *intrapetiolular glands* 2, small; *post-petiolular glands* prominent, rounded; *main cauline leaves* 1.5–6 cm long, subsessile, with narrowly thick-margined, ventrally channeled, gland-tuberculate rachis and 7–14 pairs of distant or remote, shortly petiolulate, broadly obovate to orbicular-obcordate, very obtuse to retuse leaflets 1–3 mm long, the lowest pair, situated next the pulvinus, substantially larger than the second pair, the 3 ultimate palmately 3-foliolate, the leaves associated with inflorescences similar to the rest but shorter and simpler; *peduncles* slender, terminal to all branches of the panicle, straight, or divaricate and incurved, (3) 4–7 cm long; *spikes* ovoid, very dense, without petals 10–13 mm diameter,

the silky-villous axis becoming 1–2 cm long; *bracts* tardily deciduous (perhaps clasped by the subcontiguous calyces), lanceolate, 3–5.5 mm long, at base membranous-margined, upwards firm, livid, dorsally charged with pellucid orange blister-glands, the lowest on the spike glabrous, the rest villous dorsally and ciliolate but with commonly glabrous tips; *calyx* 5–6.3 mm long, densely silky-villous-barbate, the tube 2–2.3 mm long, the slender, concolorous ribs becoming prominent in fruit, the membranous intervals charged with ± 3 tiny, transparent glands arranged in a vertical series, the subulate-setaceous, livid teeth unequal, the dorsal one longest, 3–4 mm long, all plumose, the dorsal pair separated by a shallowly recessed sinus; *petals* opening bicolored, the banner white, rubescent, the rose-purple or "blue" (*Breedlove*) epistemonous ones perched ± 0.9–1.4 mm above hypanthium, all glandless or the banner and keel-tip charged with minute glands- *banner* 3.8–4.2 mm long, the claw ± 2.2 mm, the cordate blade 1.8–2 mm long, ± 2.4 mm wide; *wings* ± 4 mm long, the claw ± 1.3 mm, the blade 2.4–2.7 mm long, 1–1.2 mm wide; *keel* 5.2–6 mm long, the claws 1.7–2.4 mm, the elliptic blades 3.5–3.7 mm long, ± 2 mm wide; *androecium* 10-merous, 5–5.8 mm long, the longest filament free for ± 1.6 mm, the connective minutely gland-tipped, the *anthers* 0.4–0.45 mm long; *pod* obliquely obovoid, ± 2 mm long, the style-base latero-terminal, the dorsal crest slender, the ventral keel and prow subfiliform, the valves hyaline at base, in the distal ⅓ submembranous, pilosulous, eglandular; *seed* ± 1.6 mm long. — Collections: 5 (o).

Sunny mountain sides in open pine-oak woodland, 1500–2250 m (5000–7500 ft), local and apparently rare, known only from 3 exact stations on the Pacific slope of Mexico in lat. 20° 30′–24°, one in n.-w. Jalisco the others in s.-centr. Durango and adjoining Sinaloa. — Flowering January to March. — *Material*: SINALOA. Rosario: e. of Santa Lucía, ± 33 mi e. of Concordia, *Breedlove 1665* (MICH). DURANGO. El Salto: Palmito, Durango-Mazatlán highway, *Gentry 11,559* (MEXU, MICH, RENNER). JALISCO. San Sebastián: near San Sebastián, *Mexia 1663* (F, GH, MICH, NY, UC, US); _____ : Tepic to Guadalajara, km 670, *M. C. Carlson 3669* (US).

Dalea pulchella (pretty) G. Don, Gen. Hist. Dichl. Pl. **2**: 224. 1832. — "Native of Mexico...(v.s. herb. Lamb.)." — Holotypus, ticketed probably in Don's hand "*Dalea pulchella*", a specimen acquired by Lambert from Pavón, presumably collected by Sessé or a collaborator, OXF!

Among winter-flowering daleas found along the west escarpment of the Mexican Plateau *D. pulchella* is marked off by an unique syndrome of characters: tall, eventually suffruticose, stiff but slender, glabrous, prominently verruculose stems; 7–14 pairs of small, round, glabrous and glaucescent leaflets of thick texture loosely set along a stiff rachis, the lowest pair of them borne close to the pulvinus and distinctly larger than the second pair; and dense ovoid spikes of relatively long-toothed, densely plumose calyces. The curious feature of an enlarged first pair of leaflets, which suggest foliose stipules at a casual glance, is known elsewhere only in *D. similis*, sympatric with *D. pulchella* along the Sinaloa-Durango border, but very different in its copious gray vesture, paripinnate leaves, and elliptic leaflets. In western Jalisco *D. pulchella* is found with or close to *D. crassifolia*, like it in growth-habit and hairless foliage, but differing in smooth stems, elliptic leaflets, dorsally recessed calyx-tube, and pallidly lavender (not vivid purple) petals. Other Mexican daleas with strongly warty stems, all (so far as known) allopatric, differ from *D. pulchella* in having fewer leaflets, or lax flower-spikes, or both. The spike of *D. pulchella* is much like that of *D. cuniculo-caudata*, a species of local dispersal in the middle Transverse Volcanic Belt (México and Michoacán); the latter, however, has essentially smooth stems charged with immersed glands, elliptic leaflets, bracts silky within, and usually vivid blue flowers. No ally closer than these mentioned comes to mind, and *D. pulchella* remains taxonomically isolated.

Gentry describes the Durango population of *D. pulchella* as consisting of woody-stemmed perennials 1–1.3 m tall; in Jalisco Mexia found the plants suffrutescent and of similar stature, but her specimens include some slender, complete individuals, with root intact, at anthesis only 4 dm tall, obviously flowering in their first year of growth.

IVC (xviii). Series Laguroideae Barneby

Slender suffruticose perennial herbs, variable in stature, the stems wiry, sometimes brittle, smooth or only remotely microtuberculate; *leaflets* of primary cauline leaves 6–15 (in one var. of *D. hintoni* only 2–4) pairs, small (1.5–6.5 mm long); *spikes* dense, ovoid or capitate; *calyx* pilosulous externally, the orifice ± recessed behind banner or strongly oblique, the intercostal membranes of tube charged with 1 (sometimes irregular) series of small glands, the triangular-subulate teeth all shorter than tube or the dorsal one a trifle longer; *petals* bicolored, the banner opening whitish, rubescent, the epistemonous ones perched below (in *D. mexiae* near) middle of androecium, rose-purple or vivid blue, the keel-blades ± 3–5 mm long. — Spp. 3, all highly localized, of the pine-oak belt and arid grasslands below it, 400–2500 m, in s. and s.-w. Mexico (Nueva Galicia and Balsas Depression).

Dalea subgen. **Parosela** sect. **Parosela** ser. **Laguroideae** Barneby, ser. nov., inter ser. *Pectinatas* et *Versicolores* quasi ambigentes, ab illis calycis membranis intercostalibus uni- vel subuni-seriatim glanduliferis, ab his calyce brevidentato, ab ambabus spica densissime pluriflora strobiliformi vel capitata, sed notulis gravibus inter omnes congruis vix discernendae. — Sp. typica: **D. cuniculo-caudata** P. G. Wils.

A small but heterogeneous group, perhaps not natural, separable from ser. *Pectinatae* by the uniseriate gland-pattern of the narrow calyx-membranes, from habitally similar members of ser. *Versicolores* by short-toothed calyces, and from both by the dense, ovoid or capitate flower-spikes. No *Laguroideae* were known to Rydberg (1920) and none fits easily into any group described in his revision of *Parosela*. In the protologue of *D. cuniculo-caudata* Wilson suggested an affinity with the yellow-flowered *D. zimapanica*. There are indeed resemblances in the form of foliage and prominently gland-tipped petals, but they are resemblances of a generalized, almost generic category.

The typical species, *D. cuniculo-caudata*, and the partly sympatric *D. hintoni* of south-central Mexico are alike in their glabrous foliage, internally silky bracts, small banner, and low-perching, long-clawed epistemonous petals; they are associated with some confidence. If they had tuberculate and not smooth stems, they would seem close and perhaps really are close to the *Tuberculatae* with capitate spikes such as *D. hemsleyana* and *D. dorycnioides*. There is a suggestive likeness in the spikes and individual calyces of *D. cuniculo-caudata* and the monotypic ser. *Pulchellae*, but the former has neither the warty stems nor the specialized leaves of the singular *D. pulchella*. The flower of *D. mexiae*, distantly allopatric in western Jalisco, differs from that of other *Laguroideae* in proportion and emplacement of the petals. The banner has a broad, plane blade and is as long as the detached keel, while the short-clawed epistemonous petals perch about midway on the androecium, well above the middle of undivided column and sheath. The plant resembles *D. hintoni* var. *hintoni* in habit of growth and in form of the spike, but the broad bracts, deciduous as in *D. cuniculo-caudata*, are glabrous within. The real affinity of *D. mexiae* is probably still to be sought, but I hesitate to create for it a monotypic series until it becomes better known. The silky foliage of *D. mexiae* is the differential character, within ser. *Laguroideae*, that is likely to be first noticed, but pubescence cannot rank high in systematic value in the context of sect. Parosela.

Key to the Species of Ser. *Laguroideae*

1. Stems and foliage glabrous below the spikes; *bracts* densely silky within; *banner* shorter than the detached keel, its blade recessed at junction with claw into a cornet; local in Balsas Depression, in s.-w. Mexico, adjacent Michoacán, and Guerrero.
   2. Spikes ovoid to subglobose, the larger ones many-flowered, becoming oblong-cylindroid, the axis 1–2.5 cm long; *interfloral bracts* deciduous; *epistemonous petals* usually vivid blue, rarely purple; *stems* virgately erect or rarely trailing, 7–15 dm long; local in s.-w. Mexico and adjoining Michoacán. 119. *D. cuniculo-caudata.*
   2. Spikes all capitately few-flowered, the axis less than 1 cm long; *interfloral bracts* persistent; *epistemonous petals* rose-purple; variable in habit and stature, where sympatric with the last the stems low, trailing, less than 5 dm long, but some allopatric forms much taller. 120. *D. hintoni.*
1. Stems and foliage silky-pilosulous; *bracts* glabrous within; *banner* proportionately ample, as long as the detached keel, its blade plane at junction with claw. Spikes capitately few-flowered as in *D. hintoni*, but bracts deciduous from between flowers. Local in Jalisco. 121. *D. mexiae.*

119. DALEA CUNICULO-CAUDATA P. G. Wilson
(Plate CVII)

Herbaceous or in age weakly suffruticulose, perennial but sometimes flowering the first season, the slender, brittle, virgately erect or rarely trailing, stramineous or brownish, smooth or distally subtuberculate stems 7–15 dm long, simple up to or beyond the middle and thence branching into an open, sparsely leafy panicle of silky spikes, glabrous below the inflorescence, the foliage bright green, the leaflets a little paler and black-punctate beneath; *leaf-spurs* less than 1 mm long; *stipules* subulate, livid, 0.5–0.9 mm long; *intrapetiolular glands* minute, impressed; *post-petiolular glands* prominent but small; *leaves* (0.8) 1.2–3 cm long, subsessile, with rather broadly margined rachis and 6–12 (14) pairs of narrowly oblong-elliptic or -oblanceolate, retuse or emarginate, cymbiform, thick-textured leaflets 1.5–4.5 mm long; *peduncles* slender, 1.5–7.5 (9) cm long; *spikes* very dense, ovoid or subglobose, the largest becoming oblong-cylindroid, without petals 10–12 mm diam, the pilosulous axis becoming 1–2 (2.5) cm long; *bracts* deciduous, narrowly lance-acuminate or sublinear, 2.5–5 mm long, livid or livid-tipped, the outermost dorsally glabrescent but ciliolate, the rest densely pilosulous on the back, all densely silky-pilosulous within; *calyx* 5–5.8 mm long, densely pilose with lustrous hairs, the tube 2.2–2.5 mm long, the ribs slender, the intervals glandless or charged with small, irregularly seriate, pallid glands, the deltate-aristate teeth unequal, the dorsal one longest, 2.5–3.1 mm long, all minutely gland-spurred; *petals* bicolored, the banner white (sometimes blue-tipped) fading dull pink-purple, the inner petals bright blue (exceptionally purple), elevated ± 1–1.7 mm above the hypanthium rim, the keel-blades united by their margins, the banner and keel (and sometimes the wings) charged at apex with a large blister-gland; *banner* 4.2–5 mm long, the claw 2–2.8 mm, the obtusely deltate-cordate blade ± 2.5 mm long, 2.4–2.8 mm wide; *wings* 4.8–6.8 mm long, the claw 1.5–3 mm, the oblong or lance-oblong blade 3.5–4 mm long, 1.4–1.8 mm wide; *keel* 6–8 mm long, the claws 2.2–3.2 mm, the obovate-elliptic blades 4–4.9 mm long, 2.1–2.8 mm wide; *androecium* 10-merous, 7–8.5 mm long, the longest filament free for ± 2 mm; *pod*

obliquely obovoid, ± 2.8 mm long, the style-base asymmetrically terminal, the valves hyaline in lower ⅔, thinly papery and pilosulous distally; *seed* ± 2 mm long. — Collections: 10 (iii).

Dry oakwoods, 1230–1900 m (± 4100–6350 ft), uncommon and of limited range, known only from valleys flowing w. and s.-w. from the massif of Nevado de Toluca towards Río Balsas in s.-w. Estado de México and immediately adjoining Michoacán. — Flowering October to January. — *Material*: MÉXICO: Chorrera, Temascaltepec distr., *Hinton 2168* (K, MICH, NY, UC): Tejupilco, Temascaltepec distr., *Hinton 1590* (GH, K, MICH, NY); 4 mi s.-w. of Temascaltepec, *Gentry, Barclay & Arguelles 19,608* (RENNER, US); w.-s.-w. of Luvianos, *Rzedowski 20,704* (ENCB); Cañada de Nanchititla, *Matuda 32,025* (MEXU); Valle de Bravo to Colorines, *Ripley & Barneby 14,879* (NY); n. of Valle de Bravo, *Ripley & Barneby 14,868* (CAS, DAO, GH, MEXU, MICH, US). MICHOACÁN: Zitácuaro — Guanoro, *Hinton 13,462* (K, MICH, NY, UC); Guanoro, *Ripley & Barneby 14,801* (CAS, DAO, GH, NY, MICH, MEXU, US).

Dalea cuniculo-caudata (cottontail, of the softly silky, scut-like spikes) P. G. Wilson, Kew Bull. **1958**: 158. 1958. — MEXICO. State of Mexico: District of Temascaltepec; Mina de Agua, 1990 m, "pine woods", 31 Oct. 1932, *G. B. Hinton 2333* (type)...." — Holotypus, K! isotypus, GH! paratypi, *Hinton 1590, 2168, 13,462*, cited above.

In the protologue *D. cuniculo-caudata* was compared with *D. zimapanica*, which is admittedly similar in form and coloring of the glabrous foliage but differs greatly in being a truly shrubby species with deciduous bracts and yellow flowers. In growth-habit *D. cuniculo-caudata* suggests the blue-flowered *D. pectinata* and its allies among which *D. pulchella* and *D. mcvaughii*, both distantly allopatric in Jalisco and northward along Sierra Madre Occidental, are technically most similar in their relatively few leaflets or dense spikes. The strongly verruculose stems of *D. pulchella* and its almost round, distant little leaflets of thick texture are decisively different. The calyx of *D. mcvaughii* is externally glabrous below its fringed orifice, and the petals lack subterminal glands. In its internally sericeous bracts *D. cuniculo-caudata* differs from all *Pectinati* except the habitally dissimilar *D. virgata*. The narrow range of *D. cuniculo-caudata* lies just within the periphery of that of the widely dispersed *D. polystachya*, which is (or can be) similar in habit of growth and is found in flower at the same season and in the same environment, sometimes sharing the same hillside. Differential characters of *D. polystachya* are the more numerous (in cauline leaves ± 12–20 not 6–12 pairs), flat rather than boat-shaped leaflets. deciduous bracts glabrous within, and less dense spikes of usually less densely pubescent calyces. Compare Plates LXVII and CVII. A notable field-character of *D. cuniculo-caudata* is the brittleness of the stems; unlike those of related species known to me in the living state they snap off abruptly when picked or when folded to lay away in press.

120. DALEA HINTONI Sandwith
(Plates CVIII and CIX)

Suffruticose perennials, variable in habit, the stems 3–10 dm long either diffuse and irregularly branching from the base upward or virgate and branching only distally, glabrous to the spikes, the livid-castaneous stems smooth except for a few small prominent glands under the heads, the foliage of rather thick texture, bicolored, the leaflets smooth and green above, paler and punctate beneath; *leaf-spurs* 0.3–0.5 mm long; *stipules* livid, becoming dry and deciduous, subulate, 0.2–0.6 mm long; *intrapetiolular glands* small, impressed; *post-petiolular glands* prominent, livid, obtuse; *main cauline leaves* either sessile or petioled, 1.5–3.5 cm long, with 2–15 pairs of

oblanceolate, elliptic, or obovate, very obtuse or emarginate, folded or openly cymbiform, dorsally keeled, bluntly gland-mucronate leaflets 2–6.5 mm long; *peduncles* terminal to leafy branchlets, or openly paniculate, (0.6) 1–3.5 (5) cm long; *spikes* ± 8–15-flowered, densely capitate, without petals 8–12 (13) mm diam, the densely pilosulous axis becoming 2–8 mm long; *bracts* persistent, ± dimorphic, the outermost broadly ovate to rhombic-obovate, subacuminate, (2.5) 3–4.5 (5) mm long, firm livid glabrous and gland-tuberculate dorsally, ciliolate toward the base, the inner ones narrower, sometimes a little longer, oblanceolate, glabrescent at middle of back, sometimes also at tip, otherwise pilosulous dorsally, all densely silky within; *calyx* (4.1) 4.5–5.9 mm long, densely pilosulous with spreading (when dry golden) hairs up to 0.5–0.8 mm long, the tube (2.5) 2.7–3.2 mm long, the ventral sinus recessed behind the banner and the orifice thus oblique, the ribs castaneous, slender but finally prominent, the narrow, membranous intervals charged with very small, uniseriate glands visible only from within or eglandular, the firm, subulate, livid or nigrescent teeth unequal, the dorsal one (1.5) 1.7–2.8 mm long (shorter than tube), the ventral pair shortest but hardly broader, all gland-spurred; *petals* at first bicolored, the banner whitish but rubescent, commonly gland-sprinkled, the inner rose-purple, all charged with a large subapical blister-gland, inserted at points ± 1.3–2.4 mm above the hypanthium rim; *banner* 4.2–5.5 mm long, the claw (2) 2.2–2.9 mm, the deltate-cordate blade recurved through ± 40–50°, 2.4–3.5 mm long, 2.7–3.6 mm wide, open at base; *wings* 4.6–6.8 mm long, the claw 1.5–2.3 mm, the oblong-oblanceolate to elliptic blade 3.1–4.7 mm long, 1.5–2.7 mm wide; *keel* 4.6–7.3 mm long, the claws 1.7–3.2 mm, the broadly obovate-elliptic to suborbicular blades 3.2–4.5 mm long, (2.2) 2.4–3 mm wide; *androecium* 10-merous, 5.1–7 mm long, the longest filament free for 1.6–2.6 mm, the gland-tipped anthers apparently whitish, 0.6–0.75 mm long; *ovary* thinly pubescent distally.

In its area of dispersal *D. hintoni* is the only perennial dalea with glabrous foliage, capitate spikes of short-toothed, densely pilosulous calyces, and persistent bracts, the outermost of which are broad and glabrous dorsally, forming a sort of calyculus under the head, but (like the inner ones) silky within. It appears to be very local, but its apparent rarity may be due in part to its usually late season of bloom, during the dry winter months. All of the four collections known are nearly monomorphic in characters of the inflorescence and detail of the flower, but they are remarkably disparate in habit and foliage. While the importance and stability of these vegetative characters remain to be tested, it seems for the present necessary to distinguish three varieties. Future collections may well modify this unavoidably limited view of the racial situation in the species.

Key to the Varieties of *Dalea hintoni*

1. Leaves petioled, the main cauline ones with 2–9 pairs of lateral leaflets, the lowest pair inserted at least as far from the pulvinus as from the next succeeding pair; low, diffuse, suffruticose plants, the flowering stems rising only ± 1–3 dm from the forest floor, the heads borne mostly on slender, ascending, secondary branchlets; pine-forest, 1100–1500 m (2).
   2. Leaflets of main cauline leaves 6–9 pairs; known only from Temascaltepec district, s.-w. Edo de México. 120a. var. *hintoni*.
   2. Leaflets of main cauline leaves 2–4 (but mostly either 2 or 3) pairs; known only from Mina district, Sierra Madre del Sur, Guerrero. 120b. var. *subbijuga*.

1. Leaves sessile, the main cauline ones with 9–15 pairs of lateral leaflets, the lowest pair inserted immediately above the pulvinus; virgately erect or ascending plants, the stems ± 6–10 dm long, paniculately few-branched distally; grassland below the forest belt, ± 400 m, known only from the Balsas valley in Aldama district, Guerrero. 120c. var. *aldamana*.

120a. Dalea hintoni Sandwith var. hintoni
(Plate CVIII)

Low, slender, diffuse shrublets from a thick,woody root, the slender flowering stems up to 3 dm long; *main cauline leaves* (drought-deciduous) 1.5–2.3 cm long, the leaflets oblanceolate to obovate, 2–5 mm long; *calyx* 4.1–5.3 mm long. — Collections: 2 (o).

Pine or mixed pine and oak woodland, ± 1100 m, apparently very local, known only from vicinity of the type-locality in s.-w. México. — *Material*: México. Temascaltepec: Luvianos trail, *Hinton 8872* (ARIZ, BM, F, K, MEXU, MICH, TEX, US, W, Z).

Dalea hintoni (George B. Hinton, 1882–1943) Sandw., Kew Bull. **1936**: 2. 1936. — "Mexico. State of Mexico: District of Temascaltepec: llano, Nanchititla, 1100 m., Dec. 7th, 1933. *Hinton 5314*." — Holotypus, K! isotypi, BM, GH, TEX, US, Z!

120b. Dalea hintoni Sandwith var. subbijuga Barneby
(Plate CVIII)

Depressed, mat-forming shrublets, the suffruticose main stems trailing, up to 6–8 dm long, the slender, ascending, mostly monocephalous flowering branchlets little over 1 (1.5) dm long; *main cauline leaves* (drought-deciduous) up to 2 cm long, the 5–9 elliptic-oblanceolate leaflets mostly 3–6.5 mm long, the upper leaves (1) 3–5-foliolate; *calyx* 4.8–5.9 mm long. — Collections: 1 (o).

Open pine-forest, ± 1500 m, known only from Mina district in Sierra Madre del Sur, Guerrero. — Flowering January to March.

Dalea hintoni Sandw. var. **subbijuga** (with ± 2 pairs of leaflets) Barneby, var. nov., a var. *hintoni* foliolis minus numerosis, foliorum caulinorum majorum 2–4 (saepissime 2 et 3)-jugis, summorum tantum 1–2-jugis recedens. — Guerrero. Mina distr.: Petlacala to El Oro, Cruz-Quemada, Sierra Madre del Sur, January 13, 1939, *Ynez Mexia 9103*. — Holotypus, NY; isotypi, ARIZ, CAS, F, GH, K, RENNER, UC, US (2 sheets)!

Apart from the reduced number of leaflets, which must be regarded as its chief differential character, var. *subbijuga* differs from var. *hintoni*, in the few specimens seen, by its better developed main stems which become distinctly woody and trailing, apparently forming mats 1–1.5 m in diameter. The inflorescence and flowers of the two varieties are virtually identical.

120c. Dalea hintoni Sandwith var. aldamana Barneby
(Plate CIX)

Taller than the 2 foregoing, the virgate stems branching distally into an open, few-headed panicle of spikes; *main cauline leaves* with subpersistent rachis but readily

deciduous leaflets, up to 3.5 cm long, the 9–15 pairs of leaflets mostly elliptic, 2.5–6 mm long, the leaves near the inflorescence smaller but still with at least 5 pairs of leaflets; *calyx* ± 5.5 mm long. — Collections: 1 (o).

Grassy hillsides, ± 400 m, known only from Cerro de la Guacamaya n. of Río Balsas, in Aldama distr., Guerrero. — Flowering November and December.

Dalea hintoni Sandw. var. **aldamana** (of Aldama, Guerrero), var. nov., ab aliis speciei formis caulibus erecto-adscendentibus virgatis tantum supra medium in paniculam apertam paucicapitatam abeuntibus, foliorum caulinorum majorum foliolis 9–15 (nec 2–9)-jugis, foliisque omnibus arcte sessilibus absimilis. Aliae speciei varietates querceta vel pineta regionis submontanae, var. *aldamana* graminosa calida regionis inferioris incolunt. — GUERRERO. Aldama distr.: among grasses on steep mountainside, 400 m, Temisco, Cerro de la Guacamaya, November 18, 1937, *Ynez Mexia 8849.* — Holotypus, CAS; isotypi, ARIZ, BH, F, GH, NY, RENNER, UC, US!

Without direct experience of the growing plant it is hazardous to interpret from pressed specimens the growth-habit of any species of *Dalea*. The var. *aldamana* appears to have virgately erect-ascending stems branching terminally into an open panicle of six or less capitate heads. The other varieties are almost certainly diffuse or weakly ascending plants in which the heads are borne solitary and terminal, in var. *hintoni* terminal to branches arising directly from the root-crown, in var. *subbijuga* to branches of the second order borne at irregular intervals along trailing suffruticose main stems. The differences in habit may be largely ecological, however, or even due to chance effect of the inadequate sample. The most striking differential character of var. *aldamana* other than the habit of growth is the high number of leaflets and the reduction of the petiole, the lowest pair of leaflets being borne at a point on the rachis no further from the pulvinus than from the succeeding pair. Nothing distinctive has been found in the bracts or in details of the individual flower.

121. DALEA MEXIAE Barneby
(Plate CIX)

Slender perennial herbs from woody roots and short suffruticulose caudex, 1.5–3.5 dm tall, silky-pilosulous throughout with soft weak subappressed and ascending hairs up to 0.2–0.4 mm long, the smooth stramineous incurved-ascending stems branched distally into a narrow, few-headed panicle and giving rise at base to many short leafy spurs, the foliage cinereous, the leaflets pubescent both sides, punctate beneath; *leaf-spurs* 0.3–0.7 mm long; *stipules* subulate or subulate-attenuate, livid becoming dry and papery, 1.2–2.5 mm long; *intrapetiolular gland* 1, spiculiform; *post-petiolular glands* small but prominent, orange; *leaves* short-petioled, the main cauline ones (drought-deciduous) up to 2.2 cm long, with narrowly margined rachis and 6–10 pairs of obovate to broadly oblanceolate, obtuse or subacute, shallowly boat-shaped, indistinctly carinate leaflets 2–3 mm long, the leaves of flowering branchlets and basal spurs smaller, with (2) 3–6 pairs of smaller leaflets; *peduncles* terminating the main and the very slender lateral axes, (1) 1.5–4.5 cm long; *spikes* very shortly or capitately ± 6–15-flowered, dense but not conelike, without petals 8–11 mm diam, the densely pilosulous axis 2–7 mm long; *bracts* persistent into late anthesis, perhaps tardily deciduous, broadly ovate-acuminate, clasping the calyx, 3–4 mm long, the outermost slightly shorter than the rest, all firm, densely pilosulous and gland-sprinkled dorsally, glabrous within; *calyx* 4.3–4.7 mm long, glabrate at base, pilosulous upward (the teeth densely so) with ascending hairs up to 0.4–0.6 mm long, the tube (measured to dorsal sinus) 2.5–2.8 mm long, deeply recessed behind banner, the ribs slender but prominulous, the membranous intervals glandless, the triangular-acuminate teeth of nearly equal length, the dorsal one 1.7–2.2 mm long, all nigrescent and minutely

gland-spurred; *petals* bicolored, the whitish banner rubescent, charged with few tiny glands, the epistemonous ones rose-purple, glandless, perched near middle of androecium, ± 2.3–2.9 mm above hypanthium; *banner* 5–5.6 mm long, the claw 2–2.6 mm, the spade-shaped, ± hooded blade recurved through 45°, open at the claw; *wings* 4–4.8 mm long, the claw 0.5–0.9 mm, the obovate blade 3.7–4 mm long, 2–2.4 mm wide; *keel* 4.8–6 mm long, the claws 1–1.7 mm, the broadly obovate-elliptic blades 4–4.4 mm long, 2.5–2.9 mm wide; *androecium* 10-merous, 6–6.5 mm long, the filaments free for ± 2 mm, the connective gland-tipped, the pallid anthers 0.5 mm long; *ovary* pilosulous; *pod* and *seed* unknown. — Collections: 2 (o).

Open oak-pine forest, 1600–2500 m, known only from two stations in the Sierra Madre in w. Jalisco (Real Alto; Cuale). — Flowering January to March. — *Material*: JALISCO. Talpa de Allende: *González 84* (vide infra).

Dalea mexiae (Ynez Enriquetta Julietta Mexia, 1870–1938) Barneby, sp. nov., affinitatis dubiae, spicis paucifloris subcapitatis densis, bracteis latis persistentibus, tubo calycino inferne glabro post vexillum profunde retrogresso, foliisque pilosulo-cinereis, caulinorum foliolis parvis saepissime 6–10-jugis ab omnibus sect. *Paroselae* recedens. Ab aliis seriei *Laguroidearum* speciebus quoad habitum spicasque subcapitatas comparandis praeter vexilli structuram alienam foliorum pube bracteisque intus glaberrimis (nec sericeis) abstat. — Herbae graciles basi suffruticulosae fere undique pilosulo-sericeae, foliis caulinis majoribus ad 22 mm foliolisque subobovatis 2–3 mm longis, spicis capitatis dense 6–15-floris, bracteis late ovatis intus glabris, calycis tubo dentibus paullo longiori, petalis bicoloribus, vexillo (carinae delapsae longiori) albido demum rubescenti, epistemoneis breviunguiculatis roseo-purpureis medium androecium versus insidentibus. JALISCO: dry open oak and pine woods. 2500 m, Real Alto, trail to Tranquillas, Sierra Madre Occidental, 9 Feb 1927, *Mexia 1715*. — Holotypus, CAS; isotypi, C, NY, RENNER, UC, US, Z.

An elegantly graceful dalea, of strong individual character, notable for the small, dense, few-flowered spikes, the broad bracts, and more especially for the mutual proportions of the petals, the ample, plane banner being larger than the high-perching, short-clawed wings and keel opposed to it. The affinities of the species are ambiguous, and it is aligned here in ser. *Laguroideae* for lack of an obviously better place, the deciding factor being the habital resemblance, quite likely coincidental, to some forms of *D. hintoni*. My key to sect. *Parosela* brings *D. mexiae* out by itself next to the likewise isolated *D. cyanea*, the features common to both being capitate spikes and proportionately big vexillum, but *D. cyanea* differs so much in its tuberculate stems, enlarged stipules, abruptly asymmetrical, broad-toothed calyx, and low-perching epistemonous petals, that a close genetic link between them seems unlikely. When better known, *D. mexiae* will probably be recognized as forming an autonomous group related in a general way to ser. *Versicolores*, ser. *Laguroideae*, and possibly to ser. *Sericeae*.

The foregoing description of *D. mexiae* was prepared from the ample type-series. A second collection (*González 84*, ENCB, MICH), from mpo. Talpa (between Cumbre de Tejamanil and Cuale, at 1600 m), is referred here with confidence, but the material is both immature (seedlings of the season) and barely coming into flower on March 3. The habitat was like that of the typus in the pine-oak belt, but 900 m lower.

IVC (xix). Series ERIOPHYLLAE Barneby

Dwarf shrublets of rounded outline up to 3 dm tall; *leaves* very small, palmately 3-foliolate; *spikes* sessile, capitate, the bracts deciduous; *teeth* of calyx slightly longer

to slightly shorter than tube; *petals* bicolored, the banner whitish, the epistemonous ones pink-purple, gland-tipped. — Sp. 1, of s.-w. Coahuila and adjoining states, sometimes gypsophilous.

Dalea subgen. **Parosela** sect. **Parosela** ser. **Eriophyllae** Barneby, ser. nov., inter affines statura minima, foliis palmatim 3-foliolatis, spicisque parvulis sessilibus notabiles. — Sp. unica: *D. eriophylla* Wats.

The curious little *D. eriophylla* was aligned by Rydberg (1920) with *D. greggii* in the group *Versicolores,* an artificial concept covering a miscellany of more or less shrubby daleas with pubescent foliage and more or less elongate calyx-teeth. The relationship of *D. greggii* is believed to lie in the direction of *D. tomentosa*; it is so different from *D. eriophylla* in growth-habit that no close kinship is suspected. The calyx and broad bracts of *D. eriophylla* recall those of *D. capitata*, another isolated type endemic to the same region, but different in the pinnately few-paired leaflets and yellow petals. In quality of pubescence and to some degree habitally, *D. eriophylla* might be thought of as a condensed derivative of *D. dorycnioides*, but it lacks the cauline warts characteristic of that species or related members of ser. *Tuberculatae*. The palmately trefoil leaves are unique in sect. *Parosela*.

122. Dalea eriophylla Watson

(Plate CX)

Diminutive, intricately branching, round-topped shrublets 1–3 dm tall, with scaly, finally nigrescent older branches, the densely leafy growth of the year not over 6 cm long, either finely white-tomentulose throughout with soft ± sinuous hairs or (var.) only the interior of the bracts and stipules tomentulose and the foliage green, the leaflets in either case punctate beneath; *leaf-spurs* 0.4–1 mm long; *stipules* ovate-triangular to triangular-subulate, 0.8–2.5 mm long, castaneous or livid, densely pilosulous either within or without, but not both sides; *intrapetiolular glands* 0; *post-petiolular glands* small, often immersed in wool; *leaves* 2.5–9 mm long, all palmately 3-foliolate, the margined, readily disjointing petiole (0) 1.5–4 mm long, the subsessile, obovate to broadly oblanceolate or linear-oblanceolate, obtuse, flat to tightly conduplicate leaflets 1.5–5.5 mm long; *spikes* terminal to branchlets, sessile and involucrate by upper stem-leaves, depressed-capitate, dense, without petals 8–10 mm diam, less than half as long; *bracts* deciduous, subdimorphic, the outermost broadly rhombic-ovate or flabellate, apiculate, 3–4 mm long, the interfloral ones rhombic-spatulate, about as long, all ± livid and gland-tuberculate dorsally, tomentulose on one side but not on both; *calyx* 4.5–5.5 mm long, densely tomentulose or glabrous externally, the tube 2.2–2.7 mm long, its orifice somewhat recessed behind banner, the ribs castaneous or pallid, the rather firm intervals charged with 1 row of 1–4 minute transparent glands, the lanceolate, minutely gland-spurred teeth 2.1–3 mm long (0.4 mm shorter to 0.5 mm longer than tube); *petals* bicolored, the banner opening whitish with yellow eye, soon rubescent, charged with few glands and gland-tipped, the epistemonous ones perched well below middle of androecium (± 1.1–2.5 mm above hypanthium), pink-purple, at least the keel gland-tipped; *banner* 4.6–6.3 mm long, the claw 1.8–3 mm, the almost erect, deltate-cordate blade 2.4–3.5 mm long, 3.2–3.8 mm wide, recessed at base into a shallow cornet; *wings* 4.6–6.7 mm long, the claws 1.3–2.3 mm, the elliptic-oblong blade 3.7–5.1 mm long, 1.5–2.4 mm wide; *keel* 5.4–7.6 mm long, the claws

2–2.7 mm, the broadly oval-elliptic blades 3.7–5.8 mm long, 2.2–3.6 mm wide; *androecium* 10-merous, 6–7 mm long, the longer filaments free for 1.6–2.2 mm, the connective minutely gland-tipped, the anthers 0.5–0.65 mm long; *pod* not seen.

A singular little dalea, instantly recognized by its diminutive shrubby form, trefoil leaves, and sessile heads of small pink and pale yellow flowers. It has no obviously close relatives, but in a general way suggests a reduced and condensed version of *D. dorycnioides*. The vesture (when present) is similar but the stems of *D. eriophylla* are not verruculose and the interfloral bracts are deciduous by anthesis. Deciduous bracts are common to *D. eriophylla* and the sometimes associated *D. greggii*, but the latter differs greatly in its procumbently arched, tip-rooting stems, more numerous leaflets, and silky rather than woolly vesture.

Known stations for *D. eriophylla* are few and far between and next to nothing is on record about its ecology. Near Galeana the plants were seen only on gypseous formations, and as gypsum is prevalent in the surface layers over much of the known range of the species, it may well turn out to be an obligate gypsophyte. Apart from the extraordinary variant described below as var. *frankenioides*, the species is essentially monomorphic.

Key to the Varieties of *Dalea eriophylla*

1. Stems, foliage and calyx-tube all densely gray- or white-villosulous; *stipules* and *bracts* glabrous internally; range of the species. 122a. var. *eriophylla*.
1. Stems white-villosulous, but foliage green and glabrous, and calyx-tube glabrous up to the ciliolate orifice; *stipules* and *bracts* glabrous and castaneous externally, densely white-pilosulous internally; known only from foothills of Sa. de Catorce, San Luis Potosí. 122b. var. *frankenioides*.

122a. Dalea eriophylla Watson var. eriophylla

(Plate CX)

Leaflets broadly oblanceolate to obovate, mostly 1–4, rarely 6 mm long, villosulous both sides, the whole plant appearing softly white- or gray-tomentellous. — Collections: 11 (i).

Barren flats and low hills, ascending into pine-pinyon forest, 1650–2800 m (5500–9300 ft), sometimes (perhaps often) on gypsum, local but forming colonies, known only from the arid inner valleys of Sierra Madre Oriental and adjoining basin ranges toward the e. margin of the Meseta Central in s.-e. Coahuila (Sierras de Parras and Pata Galana e. into mpo Arteaga), s.-w. Nuevo León (mpo Galeana), and n. San Luis Potosí (mpos Guadalcázar and Catorce); to be expected in n. Zacatecas. — Flowering March to April, July to December. — *Material*: Coahuila. Parras: Parras, *Kenoyer & Crum 3230* (GH); Sa. de Parras, *Shreve & Tinkham 9869* (ARIZ), *M. C. Johnston et al. 10,993, 10,994* (NY); Sa. Pata Galana, *Purpus 1064* (F, NY, UC). Arteaga: typus. Nuevo León. Galeana: 9 mi w. of Galeana, *Ripley & Barneby 13,791* (CAS, GH, K, MEXU, MICH, NY, US); 22 mi n.-w. of Ascensión, *Shreve & Tinkham 9737* (GH, sterile). San Luis Potosí. Guadalcázar: e. of Santa Ana Pozos, *Rzedowski 636* (ENCB, MICH, TEX); km 112, San Luis—Antiguo Morelos hwy, *Rzedowski 6475* (ENCB, MEXU, MICH). Catorce: e. of Est. Maroma, *Rzedowski 8167* (ENCB, MICH).

Dalea eriophylla (woolly-leaved) Wats., Proc. Amer. Acad. Sci. **17**: 340. 1882. — "In the Sierra Madre, forty miles south [probably e.-s.-e.] of Saltillo (211)..." — Holotypus, *Palmer 211* in 1880, from vicinity of San Antonio de Alanzanes, mpo Arteaga, Coahuila (cf. McVaugh, 1956, p. 320), GH! isotypi, F, NY, P, US! — *Parosela eriophylla* (Wats.) Rose, Contrib. U. S. Nat. Herb. **10**: 106. 1906.

The plant collected by Shreve and Tinkham northwest of Ascensión, described as forming large clumps in a mountain park at 7500 ft, is more thinly pubescent than other material of *D. eriophylla*, although the vesture is of the same finely woolly consistency. Its leaflets are also narrower and a trifle longer than usual. I. Johnston annotated the sheet at GH (which has no flowers) as an undescribed species akin to *D. eriophylla*, but it seems more likely to represent only a luxuriant phase. As elsewhere in var. *eriophylla* the bracts and stipules are glabrous within and the thin pubescence cannot in any sense be thought of as transitional to the following.

122b. Dalea eriophylla Watson var. frankenioides Barneby
(Plate CX)

Leaflets linear-oblanceolate, very strongly involute, green and glabrous, in contrast to white-villosulous internodes of the stem; *stipules* and *bracts* castaneous and glabrous dorsally, densely pubescent within. — Collection: 1 (typus).

Hot arid hillside, 2250 m, associated with *Yucca carnerosana*, in w. foothills of Sierra de Catorce, mpo Catorce, San Luis Potosí. — In flower in October, perhaps also in spring.

Dalea eriophylla var. **frankenioides** (resembling *Frankenia*) Barneby, var. nov., a var. *eriophylla* foliolis glabris viridibus, stipulis bracteisque extus glabratis castaneis intus sericeo-canis, tuboque calycino extus glabro tantum ad orem ciliolato absimilis. — San Luis Potosí: ladera caliza con vegetación de *Yucca Carnerosana*, 2250 m, 4 km al este de la Estación Marona, mpo. de Catorce, oct. 6, 1956, *Jerzy Rzedowski 8171*. — Holotypus, ENCB; isotypus (fragm), NY.

Because this remarkable plant was found growing close to a population of typical *D. eriophylla* (*Rzedowski 8167*), it would seem likely to represent nothing more unusual than one of those marked pubescence variants that are by now familiar in Amorpheae, even though not understood. This case is more complex, however, the vesture being not simply lost, but lost in part and in part regained, suggesting a dislocation of some magnitude in the genes. The bracts and stipules of var. *frankenioides* are not simply glabrate versions of the typical phase, but have the pubescence reversed, being hairless dorsally and silvery-silky within. The contrast between the small, crowded, fleshy, yellowish-green leaves and the intervening white-tomentulose interodes is particularly striking.

IVC (xxi). Series Versicolores (Rydberg) Barneby

Fruticose or suffrutescent (except herbaceous *D. pinetorum*), the stems of the year smooth or only remotely low-tuberculate; *leaflets* of primary leaves 2–17 (19) pairs, these most often carnosulous, elliptic or elliptic-obovate, 1–8 mm, rarely 11 mm long, but in *D. lutea* sometimes expanded and up to 14 mm, in *D. pinetorum* membranous; *spikes or racemes* moderately dense, neither conelike nor open; *pedicels* 0–1 mm long; *calyx* either pilose (pilosulous) from base upward or glabrous externally up to the always pubescent teeth, the intercostal panels of tube charged with 1 row of

glands, these sometimes obsolescent, the teeth subulate to aristate, mostly as long and up to twice as long as tube, commonly plumose, sometimes a little shorter than tube or pilosulous; *petals* either homochromous, when all purple or all pale yellow (fading brown or black) or bicolored, the banner then white or yellow when young, rubescent, the epistemonous petals rose or purple, these (of whatever color) perched low on androecium (0.5–3 mm above hypanthium rim), the detached keel always longer than banner, its blades 4–7.5 mm long. — Spp. 11, all but 1 either endemic to or represented by endemic forms on the Central Plateau of Mexico and encompassing sierras, 1 ranging thence widely n. into w. United States (to s. Colorado, w. Oklahoma, New Mexico, Arizona), 4 extending to s. Mexico and 2 of these to Guatemala or Honduras, 1 local in s. Arizona; not found in Baja California and poorly represented in Mexico s. of Neovolcanic Belt.

Dalea subgen. **Parosela** sect. **Parosela** ser. **Versicolores** (Rydb.) Barneby, comb. nov., based on *Parosela* subgen. *Euparosela* XXXIII. *Versicolores* Rydb., N. Amer. Fl. **24**: 101. 1920. — Sp. lectotypica: *P. versicolor* (Zucc.) Rydb. = **Dalea versicolor** Zucc.

Parosela subgen. *Euparosela* XXXV. *Lasiostachyae* Rydb., N. Amer. Fl. **24**: 106. 1920. — Sp. lectotypica: *P. lasiostachya* (Benth.) Rose = (syn. tax.) **Dalea versicolor** var. **involuta** (Rydb.) Barneby.

Parosela subgen. *Euparosela* XXXVI. *Formosae* Rydb., N. Amer. Fl. **24**: 107. 1920. — Sp. lectotypica: *P. formosa* (Torr.) Vail = **Dalea formosa** Torr.

Parosela subgen. *Euparosela* XXXVIII. *Leucostomae* Rydb., N. Amer. Fl. **24**: 109. 1920. — Sp. typica: *P. leucostoma* (Schlechtd.) Rose (incorrectly identified by Rydb., N. Amer. Fl. **24**: 110, with *D. macrostachya* Moric., which = (syn. tax.) *D. coerulea* (L. f.) Schinz & Thell.) = (syn. tax.) **D. lutea** (Cav.) Willd.

The series *Versicolores* is built up by accretion around a nucleus of *D. versicolor* sens. lat., itself an indissoluble complex of forms marked by conspicuous variation in pubescence and leaflet-number. A shrubby or at least suffrutescent habit, with smooth or only remotely low-tuberculate stems, at least moderately numerous and small leaflets, and a long-toothed calyx are the ideal syndrome of the series; but each character is subject to individual exceptions: *D. pinetorum* herbaceous; *D. botterii* sometimes rather prominently warty, *D. lamprostachya* with only 4–5 pairs of long leaflets, and *D. formosa* with about the same number of extremely small leaflets; and finally *D. wigginsii* with *D. radicans* notable for shortened calyx-teeth. Where the individual differential feature is at fault, the rest remain to point up, in most cases pretty securely, the affinity of the species.

The original concept of *Versicolores* formulated by Rydberg was too finely drawn to be realistic, determined as it was by pubescent foliage, the cognate forms with glabrous stems and leaves being segregated into a parallel ser. *Lasiostachyae*. From these two sets combined I have removed to ser. *Pectinatae* the glabrate and pubescent forms of *D. virgata* called respectively *Parosela smithii* and *P. oaxacana*, and to ser. *Tuberculatae* the strongly verruculose Baja Californian daleas that appear in Rydberg's monograph as *P. megalostachya* (pubescent) and *P. brandegei* (glabrous). Thus purified, but with a recruit in *D. formosa*, different principally in its usually short, few-flowered spike from some aspects of *D. versicolor*, the reordered series appears a truly natural unit. A further merger with Rydberg's *Lasiostomae* is perhaps a debatable step. The *Lasiostomae* are yellow-flowered counterparts of the genuine and original *Versicolores*, and subject to the same extreme type of variation in pubescence and stature. Their unique feature, yellow epistemonous petals, is unique only, however, so long as *D. botterii* is excluded, a species different from some sympatric forms of *D. lutea* only in the violet petals. This relationship between yellow-flowered *D. lutea* and violet-flowered *D. botterii* was already recognized by Rydberg, and is in my view an insuperable obstacle to segregation of a ser. *Lasiostomae*.

In this connection the parallel instance of yellow-flowered *D. capitata* in otherwise heterochomous ser. *Tuberculatae* is worth notice. With the absorption of ser. *Lasiostomae*, the also yellow-flowered *D. melantha*, referred by Rydberg to his ser. *Microphyllae* (the residue of which I combine with ser. *Thyrsiflorae*, below), falls easily into place, the pedicelled calyx being shared with several forms of *D. versicolor*, the yellow flowers no longer foreign to the group, and the often (but since discovery of var. *cineracea* not consistently) few leaflets matched in *D. lamprostachya* and *D. formosa.*

The relationship of newly defined ser. *Versicolores* to ser. *Tuberculatae* is very close, no infallible difference being applicable to all members of each series. The calyx of two *Versicolores* listed first below, *D. wigginsii* and *D. radicans*, is hardly different either in proportion of tube to teeth or in vesture from that of some *Tuberculatae*, but the kinship of each to some long-toothed (and moreover sympatric) member of ser. *Versicolores, D. wigginsii* to *D. versicolor* itself and *D. radicans* to *D. saffordii*, is expressed in a multitude of phenotypic similarities. Sundering of these pairs would defeat the purpose of serial arrangement in sect. *Parosela.*

The development of pedicels in some *Versicolores* is a notable but highly variable feature. Rydberg particularly stressed the pedicel of *D. radicans* and *D. lutea* var. *berlandieri*, which he consequently treated as members of his subgen. *Trichopodium* (= genus *Marina*, pro max. parte). These are, of course, true daleas and their pedicels are no longer than some found in races of *D. versicolor*, of *D. melantha* var. *melantha*, of *D.* (ser. *Frutescentes*) *hospes*, or of Andean *D. jamesonii.*

Key to the Species of Ser. *Versicolores*

1. Epistemonous petals all (like banner) opening pale yellow or greenish-ochroleucous, often fading (especially along nerves) brown, dull chocolate-purple, or black.
   2. Bracts between flowers persistent; *calyx* sessile; *leaflets* 5–10 (15) pairs, but either glabrous or variously pubescent; widespread over Mexico e. of Sierra Madre Oriental and s. to Honduras. 130. *D. lutea* (p. 475)
   2. Bracts between flowers deciduous by full anthesis; *calyx* nearly always short-pedicellate (pedicel (0) 0.1–1 mm); *leaflets* except in rare var. *cineracea* only 2–6 pairs and glabrous; Sierra Madre Oriental and related ranges from s. Coahuila and Nuevo León s. to Oaxaca. 131. *D. melantha* (p. 481)
1. Epistemonous petals opening and remaining rose-pink, -purple, or violet, often contrasting with a pale yellow or white (but rubescent) banner.
   3. Bracts and calyx-teeth charged both on back and margins with elongate, subulate prickle-shaped glands; local in s. Arizona. 126. *D. tentaculoides* (p. 467)
   3. Bracts and calyx-teeth glandless or charged with lens-like glands, the teeth sometimes gland-spurred marginally but never dorsally.
      4. Leaflets 2–4 pairs, densely silky-pilosulous or villosulous; if led hither, turn to ser. xv. *Psoraleoides* (p. 400).
      4. Leaflets either more numerous, or glabrous.
         5. Banner in bud and young anthesis white or pale yellow, contrasting with purple wings and keel, but rubescent in age; *interfloral bracts* commonly deciduous, if persistent the leaflets only 4–5 pairs.
            6. Primary cauline leaves ± 2.5 cm long, with 4–5 pairs of leaflets 6–11 mm long; *interfloral bracts* persistent; *petals* glandless. Shrubs of the Pacific slope in Sinaloa and Nayarit. 128. *D. lamprostachya* (p. 471)

6. Primary cauline leaves 2–20 mm long, or leaflets much more numerous and smaller; *bracts* (except in rare *D. pinetorum*, a low herb with monocephalous stems) deciduous by full anthesis; *petals* commonly (but not always) gland-tipped.
   7. Interfloral bracts persistent; *herbs* with simple stems, 2–4 dm tall and densely pilose at base with spreading-retrorse hairs; Sierra Madre Occidental in w.-centr. Chihuahua, very local. 127a. *D. pinetorum* var. *pinetorum* (p. 470)
   7. Interfloral bracts deciduous (the lowest sometimes persistent at base of spike); *stems* usually fruticose at base, commonly branched and several- or many-headed, in any case not pilose at base.
      8. Spikes mostly subcapitately 2–9-flowered and their axis less than 1 cm long (rarely a few vigorous ones longer); *leaves* mostly 2.5–11 mm long, with only 3–6 (7) pairs of leaflets ± 1–6 mm long, and glabrous; *calyx-teeth* 4.5–8.5 mm long (1.5–2 times as long as tube), plumose; s.-w. United States (s. Colorado and far. w. Oklahoma s. and s.-w.) and n.-w. Mexico (to n.-w. Coahuila, centr. Chihuahua, and n.-e. Sonora). 133. *D. formosa* (p. 498)
      8. Spikes many-flowered, or longer, or leaflets more numerous, or calyx-teeth shorter; largely more southern, but where overlapping range of *D. formosa* the leaves decisively longer and leaflets at least puberulent dorsally.
         9. Plants glabrous except in the inflorescence; slender shrubs or subshrubs of local dispersal in n. Sierra Madre Oriental and related desert ranges of Nuevo León, s.-e. Coahuila, and perhaps n. Zacatecas.
            10. Diffuse, often adventitiously rooting shrublets rising 1–2 dm from ground; *calyx* shortly pedicelled, its tube either glabrous externally or thinly pilosulous with hairs ± 0.5–0.7 mm long, the dorsal tooth 1.8–2.5 mm long, not or scarcely longer than tube. 124. *D. radicans* (p. 464)
            10. Erect or tortuous diffuse shrubs 5–15 dm tall, never radicant; *calyx* sessile, its tube densely pilose with hairs 0.8–2 mm long, the dorsal tooth mostly over 2.5 mm long and decisively longer than tube. 125. *D. saffordii* (p. 466)
         9. Plants (with rare, distantly allopatric exceptions) obviously pilosulous; Sierra Madre Occidental from s.-w. New Mexico and s. Arizona s.- and s.-e.-ward over the higher w. and s. parts of Meseta Central and through s. Mexico into Guatemala.
            11. Widely dispersed over the whole range just described, extremely polymorphic but in and near range of next, in the Sierra Madre of Durango, and nearly always elsewhere, the calyx at least 6 mm and its longer, plumose teeth 3–5 mm long. 132. *D. versicolor* (p. 486)

11. Local high on e. slope of Sierra Madre in Durango; *calyx* 4–4.5 mm, its longer tooth up to 2 mm long, shortly pilosulous. Small radicant or diffusely trailing subshrubs. 123. *D. wigginsii* (p. 463)

5. Banner in bud and permanently concolorous with wings and keel, purple or violet (sometimes banner with white eye); *interfloral bracts* persistent.

12. Shrubs and suffrutescent herbs of Sierra Madre Oriental, from Tamaulipas s. to s. Puebla and probably adjacent Oaxaca, the adult stems branched, woody and not pilose at base, over 4 dm tall; *bracts* ovate, glabrous dorsally, the tips and margins sometimes ciliolate. 129. *D. botterii* (p. 472)

12. Herbs of Sierra Madre Occidental, local in s. Chihuahua, the simple stems densely long-pilose at base and only 2–4 dm tall; *bracts* lance-caudate, pilose dorsally. 127b. *D. pinetorum* var. *anilantha* (p. 470)

123. DALEA WIGGINSII Barneby

(Plate CXI)

Slender divaricately branching shrubs up to 5 dm tall, the old stems becoming furrowed and corky, the primary axes arcuate-recurved but not (or only exceptionally) tip-rooting, the wiry secondary ones shorter, ± erect, castaneous or purplish, thinly glandular but not verruculose, like the foliage villosulous with fine spreading-ascending hairs up to 0.15–0.5 mm long, the leaflets brighter green above (exceptionally glabrescent), punctate beneath, the inflorescences silky-villosulous; *leaf-spurs* up to 0.5 mm long; *stipules* triangular-subulate, 0.5–2.5 mm long, livid-castaneous becoming papery, thinly puberulent; *intrapetiolular glands* 0; *post-petiolular glands* small but prominent, conic; *leaves* short-petioled, the main cauline ones all subtending leaf-spurs or branchlets, drought-deciduous, 5–10 mm long, mostly shorter than the internodes, with very narrowly margined rachis and (3) 4–9 (10) crowded pairs of narrowly oblanceolate, ± involute, dorsally carinate, usually gland-mucronulate leaflets (1) 1.5–3.5 mm long, the terminal one sessile, the leaves of spurs smaller, with fewer shorter leaflets; *peduncle* terminating each primary axis up to 3.5 cm long, of axillary spurs almost 0; *spikes* relatively loose and few-flowered, ovoid becoming narrowly oblong, 8–10 mm diam without petals, the flowers (pressed) falling into 2–3 ranks, the pilosulous axis finally 5–15 mm long; *bracts* deciduous (the lowest tardily), ovate to lanceolate, 2–4.5 mm long, green or purplish-castaneous, pilosulous and glandular dorsally, glabrous within; *calyx* 4–4.5 mm long, softly pilosulous with fine spreading spiral hairs up to 0.7–1 mm long, the tube 2.1–2.5 mm long, the ribs at anthesis immersed, later prominulous, the submembranous intervals charged with 1 row of ± 3 small transparent or brownish glands, the ovate-triangular, shortly acuminate or mucronate, minutely spurred, livid or brownish teeth 1.8–2.1 mm long; *petals* bicolored, the banner pale yellow, early rubescent, its blade charged with a gland-crescent, the epistemonous ones perched low on the androecium, 0.5–1.3 mm above hypanthium, the blades bright purple, the keel gland-tipped; *banner* 5.2–6.7 mm long, the claw 2.4–3.1 mm, the hooded blade 2.8–3.3 mm long, recessed at base into a

cornet, 3.9–4.2 mm wide; *wings* 4.8–5.7 mm long, the claw 1.2–1.9 mm, the elliptic or obliquely ovate blade 3.2–4.7 mm long, 1.6–2.4 mm wide; *keel* 6.4–7.8 mm long, the claws 2.6–3.5 mm, the broadly obovate blades 3.9–4.9 mm long, 2.4–3 mm wide; *androecium* (9) 10-merous, 6.5–7 mm long, the longer filaments free for 2–2.6 mm, the connective gland-tipped, the pallid anthers 0.65–0.9 mm long; *pod* and *seed* unknown. — Collections: 4 (ii).

Stony hillsides and rock-debris under cliffs, in pine-oak forest, 2100–2430 m (7000–8100 m), known only from Sierra Madre Occidental in s.-w. Durango (from ± 50 km s.-w. of Ciudad Durango to El Salto). — Flowering October to April. — *Material*: DURANGO. 29 mi s.-w. of Cd. Durango (near Los Mimbres), *Ripley & Barneby 13,489* (NY); 31 mi s.-w., cf. typus; 35 mi s.-w., *Ripley & Barneby 14,191* (CAS, MEXU, NY, US); El Salto, *Wiggins 13,202* (SD).

Dalea wigginsii (Ira Loren Wiggins, 1899–) Barneby, sp. nov., *D. versicolori* Zucc. forsan propiuscula sed ab omnibus suis formis calycis breviter pilosuli dentibus abbreviatis nec aristiformibus, spica brevi pauciflora, foliis parvis paucifoliolatis, habituque diffuso absimilis. A *D. radicanti* Wats. habitu subsimili imprimis foliis griseo-pilosulous nec glabris, inflorescentia spicata nec racemulosa, calycisque pube distantior videtur. — DURANGO: 31 mi w. of Cd. Durango on route 40, March 6, 1966, *W. Hess & M. T. Hall 545.* — Holotypus, MICH.

This charming little shrubby dalea is, like most varieties of the polymorphic *D. versicolor*, seasonally dimorphic. In October and November, following summer rains, the plants are in full vigor, the new growth is still well clothed in leaves, but there are as yet few flowers, these all borne in pedunculate spikes terminal to the wiry, divergent or trailing main stems. During winter, a period of drought and cold, the primary cauline leaves drop off, but growth continues in the form of axillary spurs, often incurved to vertical, each of which goes out eventually into a few-flowered, sessile spike or head. It is not until March or April that the plant reaches flowering peak, when all larger leaves are shed and every last twig carries a few prettily bicolored flowers, the banner yellow fading reddish, in contrast to pink-purple wings and keel. In general aspect *D. wigginsii* suggests a diminished *D. versicolor*, with greatly condensed foliage and contracted spikes, but it differs more significantly in the shortly pilosulous, broadly short-toothed calyx charged between the less prominent ribs with inconspicuous glands. Occasional stems of *D. wigginsii* root where they arch downward to touch the ground, and the plant then assumes the growth-habit of *D. radicans*, distantly allopatric at the far eastern edge of Meseta Central. This differs further in its glabrous stem and foliage, racemose not spicate inflorescence, and different vexillar structure. The species is dedicated to a distinguished student of *Dalea* in the Sonoran Desert, who was first to collect it, near El Salto, March 19, 1955.

124. DALEA RADICANS Watson
(Plate CXI)

Slender diffuse shrublets rising 1–2 dm from the ground, glabrous to the calyces except for minutely ciliolate stipules and bracts, the wiry procumbent smooth or remotely low-glandular, often livid stems often (but not always) rooting at tip and giving rise to short axillary distally leafy spurs terminating in a loose few-flowered raceme, the foliage small and sparse but thick-textured, often purple-tinged and glaucescent, the leaflets punctate beneath; *leaf-spurs* up to 1 mm long; *stipules* subulate, 0.7–1.5 mm long, firm and livid; *intrapetiolular glands* 0; *post-petiolular glands* prominent, conic; *leaves* very shortly petioled, 4–20 mm long, the primary cauline ones drought-

deciduous, mostly gone by anthesis, with narrowly margined rachis and (4) 6–11 pairs of crowded linear-oblanceolate or linear, subsessile, emarginate, folded leaflets 1.5–4.5 mm long; *peduncles* terminal to young long-shoots and to erect, axillary spurs or short-shoots, 2–6 mm long; *racemes* loosely (4) 6–12-flowered, the axis finally 5–15 mm long; *bracts* early deciduous, lance-elliptic, navicular, 2–3 mm long, gland-verrucose distally on the back; *pedicels* 0.1–0.35 mm long; *calyx* 4.7–5.1 mm long, the tube livid-castaneous when young, either glabrous externally or pilosulous with scattered weak spiral hairs up to 0.5–0.7 mm long, the ribs prominent, the intervals becoming pallid, glossy but not hyaline, charged with 1 row of ± 4 small black or livid-orange glands, the triangular to triangular-short-acuminate, minutely gland-spurred teeth silky-pilosulous within, the dorsal one longest and narrowest, up to 1.8–2.5 mm long, the ventral pair shorter and broader; *petals* opening bicolored, the banner white, purple-margined, rubescent, the epistemonous ones violet-purple, perched well below middle of androecium, all charged with a subapical gland, the banner and keel also gland-sprinkled; *banner* 5–6.8 mm long, the claw 1.5–3.1 mm, the deltate-cordate or -ovate blade 4.1–5.7 mm long, 3.3–4.2 mm wide, its basal lobes incurved and adherent to the ventral face to form lateral pockets; *wings* 4.6–7.8 mm long, the claw 0.8–2.1 mm, the oblong-elliptic blade 4.1–5.7 mm long, 2–2.6 mm wide; *keel* 4.9–8.5 mm long, the claws 1.1–3 mm, the obovate blades 4.4–5.8 mm long, 2.7–3.2 mm wide; *androecium* 10-merous, 6–7.5 mm long, the longer filaments free for 1.1–1.3 mm, the anthers 0.7–0.8 mm long; *pod* 2–2.2 mm long, in profile obliquely triangular-obovate, the style-base terminal but excentric, the prow slightly thickened, the valves hyaline in lower ⅓, thence thinly papery, gland-sprinkled, and at tip minutely pilosulous; *seed* ± 1.5 mm long. — Collections: 9 (ii).

Brushy hillsides and banks in the oak and pinyon-pine belts, on limestone or sometimes on gypsum, 1740–2350 m (5800–7830 ft), forming colonies but local and of restricted range on the dry w. slope and detached desert ranges of n. Sa. Madre Oriental in s.-e. Coahuila (mpos Cuatro Ciénegas, General Cepeda, Saltillo, Arteaga) and adjoining Nuevo León (mpo Galeana). — Flowering March to May, July to October. — *Material*: COAHUILA. Cuatro Ciénegas: Sa. de San Marcos, *M. C. Johnston et al. 10,304* (NY); General Cepeda: n. slope of Sa. de la Paila, *M. C. Johnston 11,702 C* (TEX); Saltillo: 24 km n.-w. of Fraile, *Stanford, Wetherford & Northcraft 429b* (ARIZ); 6 mi s.-e. of Saltillo, *Palmer 549* (F, GH, NY); Carneros Pass, *Pringle 2807* (A, MEXU). Arteaga: Saltillo mts. on road to Pto. de Flores, *Boke & Massey 224* (MICH); Pto. de Flores, 20 mi s.-e. of Saltillo, *Ripley & Barneby 13,284* (CAS, K, MEXU, MICH, NY, US); near San Antonio de Alanzanes (typus). NUEVO LEÓN. Galeana: 12 mi s. of Pablillo on road to Ascensión, *Ripley & Barneby 14,777* (NY).

Dalea radicans (rooting, of the procumbently arching stems) Wats., Proc. Amer. Acad. **17**: 341. 1882. — "In the Sierra Madre, south [= e.-s.-e.] of Saltillo ([Palmer] 214)." — Holotypus, collected in late July, 1880, GH! isotypi, NY (2 sheets), US! — *Parosela radicans* (Wats.) Rose, Contrib. U. S. Nat. Herb. **8**: 305. 1905.

An attractive little procumbent shrublet with livid wiry branchlets, neat sparse foliage of a livid green or glaucescent hue, and modest spiciform racemes of a few violet and white flowers. The plants are seasonally dimorphic, producing in the rainy season pliant long-shoots with internodes longer than the leaves and sometimes bearing a terminal inflorescence below a seemingly continuous, really sympodial secondary axis, and in the dry season, from axils of drought-deciduous cauline leaves, stiffly erect short-shoots clothed in smaller leaves and terminating in a smaller, often subcapitate raceme. It is the long-shoots that take root where they touch the ground, but many fail to do so. Most of the flowers, as in *D. saffordii*, are borne on short-shoots.

Rydberg, no doubt misled by the presence of short but evident pedicels, entirely misunderstood the relationship of *D. radicans*, placing it (1919, p. 56) far distant from all possible kindred among shrubby marinas of Baja California. It is here interpreted as derived from the stock that gave rise to the sympatric *D. saffordii* and to *D. melantha*, both different in habit because of their taller frutescent stature, but in foliage and in details of the corolla (especially of the laterally pouched banner-blade) suggestively similar. Habit apart, *D. saffordii*, the range of which is almost coextensive with that of *D. radicans*, is easily distinguished by the densely pilose, almost glandless, long-toothed calyces sessile on the spike-axis, and by the bright pink-purple rather than dull but intense violet coloring of the epistemonous petals. The pale yellow petals of *D. melantha* are different from both, and the form sympatric or nearly so with *D. radicans* is the easily distinguished *D. melantha* var. *berlandieri*, characterized by 2–3 pairs of broad leaflets and long, loose flower-spikes.

125. Dalea saffordii (Rose) Bullock
(Plate CX)

Low tortuous or more erect and slender, twiggily branching shrubs up to 5–15 dm tall, glabrous to the inflorescence, the old wood becoming furrowed and striped lengthwise, the young branches smooth, castaneous or livid, glandless or almost so, the sparse foliage mostly deciduous before anthesis, the small, thick-textured leaflets green above, paler and punctate beneath; *leaf-spurs* 0.4–1.6 mm long; *stipules* triangular-subulate, 0.7–1.3 mm long, firmly papery, livid, persistent; *intrapetiolular glands* 0; *post-petiolular glands* prominent, conic, usually purple; *leaves* subsessile, the main cauline ones (little known) up to 1–1.6 cm long, with thick-margined punctate rachis and 5–9 crowded pairs of obovate to oblong-elliptic or oblanceolate, emarginate, mostly folded and dorsally carinate leaflets ± 1.5–3 mm, the leaves of spurs contemporaneous with the flowers smaller, mostly 4–10 mm long, with only (2) 3–5 pairs of smaller leaflets; *spikes* terminal to main branches and to short axillary spurs, pedunculate or sessile, the peduncle not over 2 cm long, the spike ovoid-capitate becoming subglobose to shortly oblong in outline, dense but not conelike, without petals (8) 9–14 mm diam, the densely pilosulous axis becoming 5–15 mm long; *bracts* deciduous, dimorphic, the lowest ovate-acuminate to obovate-flabellate, resembling stipules in color and texture, 1.5–3.5 mm long, glabrous dorsally, ciliolate, the interfloral ones broadly lance- to narrowly elliptic-acuminate, 3.5–5.5 mm long, pilosulous dorsally and plumose-ciliolate, usually livid or castaneous distally, glabrous within; *calyx* sessile or almost so, 4.8–7.7 mm long, densely pilose with fine, at length spreading hairs up to 0.8–2 mm long, the tube (measured to a dorsal sinus) 2.4–3.1 mm long, moderately recessed behind banner, the ribs thick, becoming prominent and castaneous, the rather firm intervals glandless or charged with 1–3 minute golden glands visible only from within, the triangular-aristate at length stellately spreading teeth (2.2) 2.6–4.7 mm long, the dorsal one longest (up to 1.7 mm longer, rarely a trifle shorter than tube), all gland-spurred and plumose except for sometimes glabrate tips; *petals* bicolored, the whitish or pale yellow banner early rubescent, sometimes gland-sprinkled, the epistemonous ones perched low on androecium (0.8–1.4 mm above hypanthium), all (or banner only, or keel only) charged with a subapical gland; *banner* 6.6–7.2 mm long, the claw 2.9–4.4 mm, the deltate-ovate, hooded blade 2.8–4 mm long, 3–3.8 mm wide, the basal lobes involute-adherent to form lateral pockets; *wings* 6.1–7.5 mm long, the claw 1.8–2.5 mm, the oblong-elliptic or -lanceolate blade 4.4–5.5 mm long, 1.9–2.4 mm wide; *keel* 6.2–9.5 mm long, the claws 2–3.6 mm, the

broadly elliptic blade 4.2–6.3 mm long, 2.6–3.5 mm wide; *androecium* 10-merous, 6–9 mm long, the filaments free for 2.2–3.5 mm; *pod* (not seen ripe) obliquely triangular in profile, 3–3.5 mm long, the style-base excentrically terminal, the valves membranous and glabrous in lower ½, thence thinly herbaceous, pilosulous, minutely gland-sprinkled; *seed* not seen. — Collections: 7 (o).

Rocky hillsides and canyon-benches, 2250–2800 m (± 7300–9300 ft), on limestone, apparently very local, known only from the w. slope of n. Sierra Madre Oriental and detached but related desert ranges immediately to the w. in mpos Arteaga, Saltillo, and Parras in s.-w. Coahuila and mpo Galeana in adjoining Nuevo León. — Flowering February to June. — *Material*: COAHUILA. Parras: Sa. de Parras, *M. C. Johnston 10,993* (TEX); Sa. Pata Galana, *Purpus 1068* (F, NY, UC). Saltillo: canyon s. of Saltillo, *Hinton 16,736* (US). Arteaga: "12–14 leagues s." of Saltillo, *Palmer 208* (NY, US); 35 mi e. of Saltillo (5–6 mi e. of Lirios), *McVaugh 12,324* (MEXU, MICH). NUEVO LEÓN. Galeana: s.-e. of Galeana, *Rzedowski 27,174* (ENCB).

Dalea saffordii (Rose) Bullock, Kew Bull. **1939**: 198. 1939, based on *Parosela saffordii* (William Edwin Safford, 1859–1926) Rose, Contrib. U. S. Nat. Herb. **12**: 273. 1909. — Collected by William E. Safford, February 3, 1907 (no. 1246). The same species was collected in 1880 (no. 208) Dr. E. Palmer..." — Holotypus, *Safford 1246*, US! paratypi, *Palmer 208*, cit. supra.

A small, gnarled, highly xerophytic shrub, the richly colored flowers large in proportion to the foliage. The species has been collected seldom, but flowers in late winter and spring, the dry season in its desert range, when few botanists are about. As often in sect. *Parosela*, the specific distinctness of *D. saffordii* is more easily discerned than its affinities. Rydberg (1920, p. 107) aligned it with *D. formosa* in a little group composed of these two species with the quite distinct *D. purpusi* of Baja California; his concept of it, however, was adulterated by a specimen of *D. versicolor* var. *calcarata* from Durango (*Palmer 138*, NY), a mistake to which may be traced the supposed occurrence of *D. saffordii* in Sierra Madre Occidental. While I agree that it belongs in the circle of affinity with *D. versicolor* sens. lat., I suspect a closer relationship to the marginally sympatric *D. radicans*, which it much resembles in fine detail of foliage, stipules, and flower (especially the banner), although strikingly different in its more erect habit, densely plumose calyx, and longer calyx-teeth.

126. DALEA TENTACULOIDES Gentry
(Plate CXI)

Suffruticose becoming fruticulose and 3–6 dm tall, the 1 or few primary stems bushy-branched from near base, either glabrous to the spikes or minutely thinly pilosulous with narrowly ascending hairs up to 0.2–0.3 mm long, the young branches green, striate, rather densely livid-tuberculate becoming in age brown and furrowed, the foliage green, the leaflets smooth above, prominently gland-punctate but little paler beneath; *leaf-spurs* 0.3–0.8 mm long; *stipules* subulate, pallid-green or whitish, 0.4–2 mm long, deciduous; *intra-* and *post-petiolular glands* prominent but small, blunt, purplish; *primary cauline leaves* 3–6 cm long, early deciduous and lacking from most flowering specimens (consequently little known), up to 3–6 cm long, with narrowly thick-margined, punctate rachis and 9–17 pairs of oblong-elliptic, elliptic, or obovate, nearly always emarginate, flat or shallowly navicular, obscurely or not dorsally carinate leaflets 2.5–8 mm long, the leaves of spurs shorter and simpler, 3–8 pairs, often smaller; *spikes* terminal to leafy spurs and branchlets, subsessile and short-

pedunculate, moderately dense, ovoid-pyramidal becoming globose or shortly oblong, without petals or androecia 11–15 mm diam, the pilosulous axis 1–2 (2.5) cm long; *bracts* either persistent or tardily deciduous, (2.5) 3–5.5 mm long, narrowly elliptic-oblanceolate, attenuate both ends, pallid at base, distally green, thinly herbaceous, charged on back and margins with several subulate or prickle-shaped glands (sometimes a few obtuse or lens-like), dorsally pilosulous below middle or glabrous, ciliolate; *pedicels* 0 or obscure, subtended by minute gland-spicules; *calyx* 5.2–7.8 mm long, thinly pilosulous (pilose) with fine, spreading-ascending spiral hairs up to 0.8–1.2 mm long, the pale-golden, membranous tube 2.5–3.1 mm long, deeply recessed behind banner, the ribs filiform, not or scarcely prominent, concolorous, the pleated intervals glandless or charged with 1–2 minute glands, the narrowly lance-acuminate, green teeth of nearly equal length, the dorsal one 2.7–4.7 mm long (0.2–1.6 mm longer than tube), all resembling the bracts in texture and like them charged on back and margins with several subulate gland-prickles; *petals* bicolored, the banner opening whitish, early rubescent, the epistemonous ones rose-purple, inserted ± 1.5–2 mm from hypanthium, all charged with a subapical gland but otherwise glandless; *banner* 6.2–6.7 mm long, the claw 3–3.2 mm, the openly flabellate blade hooded distally, thickened at base but scarcely recessed into a cornet; *wings* 6.4–7.8 mm long, the claw 1.7–2.4 mm, the oblong-obovate or lance-ovate blade 4.9–5.8 mm long, 2.2–3 mm wide; *keel* 7.7–9.5 mm long, the claws 2.7–3.8 mm, the broadly elliptic-obovate blades 5–6.2 mm long, 3.2–4.4 mm wide; *androecium* 8–9.5 mm long, the longer filaments free for ± 2.6–3.5 mm, the connective gland-tipped, the anthers 0.75–0.95 mm long; *pod* ± 3 mm long, compressed, in profile triangular, the ventral suture longest, the style-base terminal, the prow slender-carinate, the valves glabrous and hyaline in lower half, thence thinly papery and pilosulous; *seed* ± 1.5 mm long. — Collections: 6 (o).

Open rocky slopes in the oak-belt, up to ± 1350 m, rare and local, known only from the Sierrita and Baboquivari mountains in Santa Cruz and adjoining Pima counties, Arizona. — Flowering September–November, April–May. — *Material:* ARIZONA. Santa Cruz: typus; Pima (all from Baboquivari range): *Goodding s. n. in 1935* (ARIZ); Baboquivari canyon, *Peebles & Harrison 3965* (ARIZ), *Loomis & Peebles 1597* (ARIZ); Toros canyon, *Harrison & Kearney 8632* (ARIZ, US); Kitt Peak, *L. Andrews in 1967* (NY).

Dalea tentaculoides (of the long gland-prickles on bracts and calyx-teeth) Gentry, Madroño **10**: 238, Pl. 18, 19, and fig. 2 (map). 1950. — "Type. Sycamore Canyon, between Nogales and Ruby, Arizona, May 9, 1941, *Darrow s. n.* (ARIZ, no. 30239..." — Holotypus, ARIZ!

A species without obviously close kindred, but as noted by Gentry in the protologue possibly allied to *D. versicolor* sens. lat. The one member of the group sympatric with *D. tentaculoides* is *D. versicolor* var. *sessilis*, distinguished by its fewer pairs of leaflets, in primary cauline leaves mostly 4–9 (not 9–17), the thin texture and usually dense pilosulous vesture of the leaflets themselves, the fugacious interfloral bracts, and the absence of strangely elongate, "tentacular" gland-spurs on these and the calyx-teeth. Gentry pointed out that rather similar but much less exaggerated glands are found occasionally in forms of what is here called *D. versicolor* sens. lat., but when present they coincide with pronounced blister-glands in the intercostal panels of the calyx-tube, absent or obsolescent in *D. tentaculoides*. The species is to be sought in outlying spurs of Sierra Madre south of the border in Sonora.

127. DALEA PINETORUM Gentry
(Plate CXII)

Herbaceous from a slender, oblique, perennial rootstock, 2–4 dm tall, the few (mostly 1–2) striate, greenish or livid-castaneous, simple and monocephalous, minutely glandular but not tuberculate stems finely pilose throughout with spreading or toward the base sometimes retrorse hairs up to 0.8–2 mm long, rather densely leafy in the upper half, giving rise at base, late in the season, to small, densely villous, leafy spurs, the foliage green, pilosulous like the stems but with slightly shorter hairs, the submembranous leaflets pubescent both sides or glabrescent above, closely and abundantly livid-punctate beneath; *leaf-spurs* subobsolete up to 0.6 mm long; *stipules* linear- or lance-acuminate, 4–9 mm long, herbaceous becoming papery-castaneous, pilosulous and charged with 2 lines of glands dorsally, glabrous within; *intrapetiolular glands* small; *post-petiolular glands* small but prominent, obtuse or mammiform; *main cauline leaves* 2–4 cm long, subsessile, with narrowly margined rachis and 7–16 (19) pairs of leaflets variable in shape as described for the varieties, but always flat or shallowly boat-shaped, never conduplicate, carinate dorsally, 3–8 mm long; *peduncles* 0–4.5 cm long; *spikes* dense but not conelike, subglobose to oblong-cylindroid, without petals 13–16 mm diam, the pilosulous axis becoming 1.5–5 cm long; *bracts* persistent, lance-caudate beyond the linear-cuneate base, 5.5–7 mm long, the thinly herbaceous, livid-green, gland-charged blade pilose externally, glabrous within; *calyx* 5.6–8.3 mm long, plumose-pilose throughout or only from the orifice upward, the tube 2–2.7 mm long, not or scarcely recessed behind the banner, the ribs slender but corneous, pallid or castaneous, the hyaline, flat intervals charged with 1 row of 3–4 orange blister-glands, the narrowly subulate-aristiform, gland-spurred, livid teeth unequal, the dorsal one longest, divergent in age, 3.5–5.6 mm long (1.5–3.5 mm longer than tube), the ventral pair a little shorter but hardly broader; *flowers* either bicolored or homochromous except for a pale eye in blade of the banner, the petals sometimes gland-charged (variable in the varieties), the inner ones elevated 1.5–2.8 mm above the hypanthium rim; *banner* 6.6–7.5 mm long, the claw 3.1–3.5 mm, the suborbicular, hooded blade 3.8–4.8 mm long, closed at base to form a cornet-like well; *wings* 6–6.8 mm long, the claw 1.7–2.1 mm, the oblong blade 4.6–4.8 mm long, 2.1–2.3 mm wide; *keel* 6.7–7.1 mm long, the claws 2–2.5 mm, the blades ± 5 mm long, 2.5–2.8 mm wide; *androecium* 10-merous, 8.5–11 mm long, the longest filament free for 2.5–3.3 mm; *ovary* membranous, pilose beyond the middle, the pod and seed unknown.

The two known major populations of *D. pinetorum* lie distant nearly 300 kilometers one from the other, one on an outlying western spur of the Sierra Madre, on the watershed of Ríos Mayo and Mulatos, the other near the crest of the main range at the sources of Río Verde. The plants collected in these mutually remote spots are clearly of the same species, but differ in so many small features that I feel obliged to grant them some taxonomic recognition. Obviously a classification based on such small samples must be tentative at best, and will need revision as and when the range of the species becomes more fully known.

Key to the Varieties of *Dalea pinetorum*

1. Main cauline leaves composed of 9–16 (19) pairs of elliptic to lance-elliptic, acute leaflets diminishing in size upward along the rachis; *base of stem* pilose

with retrorsely descending hairs up to 1.5–2 mm long; *calyx-tube* glabrous up to the orifice, the teeth plumose; *petals* bicolored, the gland-sprinkled banner pale, rubescent, the inner ones purple; extreme w.-centr. Chihuahua, at ± 109° W., 28° N., and immediately adjacent Sonora (mun. Yécora). 127a. var. *pinetorum*.

1. Main cauline leaves composed of 7–10, mostly 8 or 9 pairs of oblong-obovate, obtuse or emarginate leaflets of about equal size; *base of stem* pilose-pilosulous with spreading hairs ± 0.8–1.2 mm long; *calyx-tube* pilosulous from base upward; *petals* indigo-blue, the glandless blade of the banner variegated with a pallid, rubescent eye; extreme s.-w. Chihuahua, at ± 106° 40′ W, 26° 20′ N. 127b. var. *anilantha*.

127a. Dalea pinetorum Gentry var. pinetorum
(Plate CXII)

Characters as given in key; *calyx* ± 8 mm long, the tube 2.7 mm, the dorsal tooth 5–5.5 mm long, plumose with hairs up to 1 mm long or more. — *Material*: Chihuahua: typus and paratypus; Sonora: Yécora, *S. Walker, Mex 9* (NY).

Among pines in the pine-oak belt, ± 1500 m (5000 ft), known only from along the Sonora-Chihuahua boundary between Yécora, Sonora, and Mesa Colorada, Chihuahua, on and near the Rio Mayo-Rio Mulatos divide. — Flowering September–October.

Dalea pinetorum (of pinewoods) Gentry, Madroño **10**: 232, Pl. 16, fig. 2 (map). 1950. — "Type. La Mesa Colorada in Sierra Madre of western Chihuahua, Mexico...October 12, 1933, *Gentry 529*..." — Holotypus, DS (not seen); isotypi, ARIZ, MICH! paratypi, *Gentry 653* from Sierra de las Papas, MICH (mostly lvs).

127b. Dalea pinetorum Gentry var. anilantha Barneby
(Plate CXII)

Characters as given in key; *calyx* 5.6–6.8 mm long, the tube ± 2 mm, the dorsal tooth 3.5–4.8 mm long, plumose with hairs 0.8–1.2 mm long. — Collections: 1 (typus).

Open pine-oak woods, ± 2010 m (6700 ft), known only from Sierra Chinatú, near the source of Río Verde in Sierra Madre Occidental, extreme s.-w. Chihuahua. — Flowering September–November.

Dalea pinetorum Gentry var. **anilantha** (with indigo-blue flowers) Barneby, var. nov., a var. *pinetorum* foliolis minus numerosis 7–10 nec 10–19-jugis obtusis vel emarginatis nec acutis, calyce ab imo basi piloso (nec tubo glabrato), petalisque concoloribus saturate coeruleis nec bicoloribus (vexillo pallido, interioribus purpureis) recedens. — Chihuahua: near Chinatú, in open pine-oak woods on Sierra Chinatú, 6700 ft., October 9, 1959, *D. S. Correll & H. S. Gentry 22,969*. — Holotypus, RENNER.

Many species of *Dalea* are highly variable in characters of pubescence and flower-color; a few vary a good deal in number of leaflets. The low taxonomic value of the characters is only perceived, however, in the context of long sets of specimens or, occasionally, in polymorphic single populations. It is statistically improbable that several such characters should be found grouped, as in the varieties of *D. pinetorum*, within the confines of the first two populations discovered, and for this reason I feel justified in describing var.

anilantha as distinct. Few leaflets, obtuse leaflets, pubescent calyx-tube, blue flowers, each might be expected in a given collection, but hardly all together. The highly dissected topography of the Sierra Madre undoubtedly encourages or at least permits the development of genetically distinct races within the species, and I feel confident that var. *anilantha* is one of these.

128. DALEA LAMPROSTACHYA Barneby

(Plate CXIII)

Probably shrubby but of unknown stature, glabrous to the inflorescence, with smooth, livid-castaneous young stems, the foliage dark green, the thick-textured leaflets smooth above, punctate dorsally and marginally with livid glands, the spikes thinly pilose; *leaf-spurs* 0.8–1.3 mm long; *stipules* lance-subulate, livid, 1.5–4 mm long; *intrapetiolular glands* 3, blunt; *post-petiolular glands* large, prominent, blunt; *leaves* shortly petioled, the main cauline ones ± 2.5 cm long, with narrowly thick-margined, punctate rachis and 4–5 pairs of narrowly oblong-elliptic, obtuse, openly boat-shaped, gland-crenulate leaflets 6–11 mm long, the cauline leaves each subtending a spur clad in similar but smaller leaves; *peduncles* terminal to leafy branchlets, 1.5–5.5 cm long; *spikes* moderately dense, the many flowers subcontiguous when pressed but not fully concealing the thinly pilose axis, without petals obtusely ovoid becoming cylindroid ± 18 mm diam, the axis finally 4–9 cm long; *bracts* persistent, dimorphic, the lowest broadly lanceolate from cuneate base, thick-textured and densely glandular from base upward, glabrous, 5–7 mm long, the interfloral ones oblanceolate, up to 9 mm long, acuminately narrowed downward from near middle, thick-textured distally, thinly long-pilose on back and margins; *calyx* (sessile) 8.7 mm long, thinly pilose with fine straight ascending and spreading spiral hairs up to 1.7–2.2 mm long, the tube (measured to dorsal sinus) 3.2 mm long, strongly recessed behind banner and the orifice hence oblique, the ribs prominent, orange-castaneous, the membranous intervals charged with 3–5 very small, irregularly 1-seriate, subtransparent glands, the teeth narrowly triangular-acuminate, livid-nigrescent, gland-spurred, of about equal length, stellately spreading and plumose in fruit, the dorsal one 5.5 mm long; *petals* bicolored, the banner opening white, then rubescent, the epistemonous ones rose-purple (the keel-blades pale-edged externally), perched low on androecium (1.5–2 mm above hypanthium), all glandless; *banner* 9 mm long, the claw 6 mm, the deltate-cordate, subacute, ± hooded blade recurved through 40°, 4 mm long, 5.2 mm wide, recessed down top of claw into a groove opening adaxially; *wings* 9.8 mm long, the claw 4.1 mm, the oblong-oblanceolate blade 6 mm long, 3 mm wide; *keel* 11.7 mm long, the claws 5.3 mm, the broadly obovate-elliptic blades 7 mm long, 4.5 mm wide; *androecium* 10-merous, 11 mm long, the longer filaments free for 3 mm, the connective gland-tipped, the anthers 0.85–1 mm long; *pod* in profile broadly obovate, the style-base lateral just below apex, 3.5 mm long, 3 mm wide, the valves glabrous, membranous at very base, thence firm, livid, rugulose; *seed* 2.2 mm long. — Collection: 1 (typus).

Habitat not recorded, but to be sought in the oak-pine belt near or above 1100 m, known only from Sierra de Chavarría, a spur of Sierra Madre Occidental projecting w. from the main chain across the Durango-Sinaloa boundary in lat. ± 23° 40 N; perhaps also (cf. discussion) on Cerro San Juan near Tepic, Nayarit. — Flowering probably in winter.

Dalea lamprostachya (with splendid spikes) Barneby, sp. nov., affinitatis ignotae, cum *D. versicoloris* varietatibus nonnullis ob calycis longidentati formam pubemque comparanda, sed bracteis magnis persistentibus, floribus spicisque maximis, necnon ovario glaberrimo distinctissima. A *D. sericocalyce* (Rydb.) Riley verosimiliter sympatrica et quoad calycem longidentatum vexillique formam simili foliolis angustis carnosis glabris, bracteis persistentibus necnon ovario glabro distantior videtur. — Verosimiliter frutex, infra spicas glaberrima; *folia* majora caulina ± 2.5 cm longa, foliolis 4–5-jugis oblongo-ellipticis navicularibus crasse carnosis 6–11 mm longis, facie inferiori et secus marginem subcrenulatam glanduloso-punctatis; *spicae* brevipedunculatae maximae subdensae multiflorae 4–9 cm longae, petalis androeciisque ablatis ± 1.8 cm diam; *bracteae* persistentes dimorphae, imae glabrae ex ipso basi crasse herbaceae lividae, interflorales oblanceolatae infra medium submembranaceae margine dorsoque supra medium pilosae; *calycis* pilis rectis fere 2 mm longis pilosi tubus 3.2 mm longus post vexillum valde retroscissus, dentes triangulari-caudati inter se subaequilongi 5–5.5 mm longi; *petala* bicoloria, vexillo albido mox rubescenti, epistemoneis purpureis multo infra medium androecium insidentibus, carinae laminis 7 mm longis, 4.5 mm latis; *ovarium* ac *legumen* glabra, hujus valvulae supra basin membranaceum firmae lividae. — SINALOA (or perhaps adjoining DURANGO): Sierra de Chavarría, anno 1921, *Jesús G. Ortega 4053*. — Holotypus, US; isotypus, MEXU.

A remarkable dalea, notable for the livid-castaneous color of the stems, the relatively few (9–11) but long leaflets of thick texture, and handsomely barbate fox-tail spikes of large white and purple flowers interleaved with persistent, glandular bracts. Because of the long-toothed calyx clad in long spiral hairs it is natural to compare *D. lamprostachya* with *D. versicolor*, a species diverse internally but in all its phases separable by its deciduous bracts, gland-tipped petals, and gland-sprinkled, more or less pilose ovary and pod. The form of *D. versicolor* that most nearly resembles *D. lamprostachya* in vegetative characters is var. *involuta*, but this differs further in its smaller flower and narrower spike. Sympatric varieties of *D. versicolor* have more numerous, smaller leaflets, or pubescent foliage, or both. A dalea perhaps more closely related, though not really similar, is the still poorly known *D. sericocalyx*, collected only once in the same segment of Sierra Madre Occidental, somewhere between Mazatlán and Durango. This resembles *D. lamprostachya* in its long-toothed calyx and form of petals, but differs greatly in its pubescent foliage, more numerous leaflets of broad outline, and deciduous bracts, The growth-form and stature of *D. lamprostachya* and *D. sericocalyx* are unknown, so that an evaluation of their possible kinship is not really possible.

Sterile specimens of a dalea probably referable to *D. lamprostachya* were collected at about 1100 m on the north slope of Cerro San Juan west of Tepic, Nayarit (*Ripley & Barneby 14,049a*, CAS, NY), showing no sign of flower-buds in early October although bearing the naked spike-axes of the preceding season. These plants, which occurred in small quantity and as isolated individuals in the understorey of open pine-forest, took the form of a tall virgately monopodial shrub, the castaneous stem simple for a meter or more and branched distally into a small leafy panicle. The foliage was notably lustrous when fresh, vivid green. The leaflets are remarkable for bearing a row of glands on or close to the more or less involute margins, which appear minutely undulate-denticulate when dry.

129. DALEA BOTTERII (Rydberg) Barneby
(Plate CXIV)

Shrubs up to 1.2 m tall, paniculately branched distally, the older stems brown, tuberculate, glabrous or glabrescent, the young branchlets purplish, villosulous, the

foliage varying from glabrous to thinly pilosulous, the leaflets glabrous both sides, or above, or thinly hairy both sides, green or subglaucescent, prominently black-punctate beneath; *leaf-spurs* 0.8–2 mm long; *stipules* lanceolate to narrowly triangular, (1) 1.5–5.5 mm long, usually purplish, glabrous or glabrate; *intrapetiolular gland* 1, small; *post-petiolular glands* prominent, usually livid, globose or conic; *main cauline leaves* 2–3.5 cm long, shortly petioled, with smooth, scarcely margined rachis and 7–13 pairs of leaflets varying in shape and number according to the variety (defined below); *peduncles* terminal to branches and to some lateral spurs, 0.3–2 cm long; *spikes* many-flowered, moderately dense (flowers 2–3-ranked when pressed), narrowly pyramidal becoming cylindric, without petals 12–15 mm diam, the villosulous axis becoming 1–7 cm long; *bracts* persistent, ovate- to lance-acuminate or -caudate, firmly papery, livid-castaneous or blackish, either quite glabrous dorsally or ciliolate about the keel and tail, often thinly tuberculate; *calyx* 4.7–8.2 mm long, the tube 2.4–3.1 mm long, glabrous or nearly so in the lower ⅓–⅔, thinly pilosulous distally, like the teeth, with spreading-ascending hairs up to (0.4) 0.5–0.9 mm long, the stout ribs castaneous, the intervals firm, charged with 2–5 (6), usually black or livid blister-glands, the mouth oblique but not recessed dorsally, the teeth unequal, the dorsal one longest, varying from 0.3 mm shorter to 2.4 mm longer than the tube, all 5 triangular-acuminate or -aristiform, gland-spurred; *petals* concolorous, violet- or indigo-purple, drying rose-brown to black, the banner and keel gland-tipped, the banner often charged with a gland-crescent, the wings and keel elevated ± 1.1–2.4 above the hypanthium; *banner* (5.6) 6.2–7.5 mm long, the suborbicular blade 3–4.4 mm long, (3) 3.4–5 mm diameter, recessed into a cornet at base; *wings* 5.6–7.8 mm long, the claw 1.6–2.4 mm, the oblong-oblanceolate blade (4.2) 4.6–6 mm long, 1.8–2.6 mm wide; *keel* 7.3–10.7 mm long, the claws 2.6–4.7 mm, the blades 5.1–7.4 mm long, 2.9–4 mm wide; *androecium* 6.8–11 mm long, the longest filament free for 2.4–3.5 mm; *anthers* 0.6–0.8 mm long.

The syndrome of characters that distinguishes *D. botterii* is the shrubby growth-habit combined with persistent, livid or blackish bracts glabrous or nearly so dorsally, a calyx hairless toward the base of the tube but villosulous about the mouth and teeth, and petals of some shade of violet or indigo-purple that turns rose-brown to black when dried. Except for the color of the petals *D. botterii* cannot well be told apart from the sympatric *D. lutea*. Possibly it may consist of several mutually independent color-variants of the latter species. At present we have no evidence bearing on the point, and as there is no other known instance of purple flowers and yellow flowers existing in the same species of *Dalea*, it seems prudent, pending analysis of the pigments, to maintain *D. botterii* as distinct. I have not seen the fresh flower of var. *atrocyanea*; its black coloring hardly differs when dry from that seen in some strains of *D. lutea* which are known to have been yellow when fresh, but in the buds traces of indigo-blue can be seen. The petals of var. *botterii*, at least on the Cumbres de Acultzingo between Tehuacán and Orizaba, where the species was first collected by Liebmann in 1841, are violet and concolorous. The color is perceptibly different from any of the pink-purples prevalent among Mexican shrubby daleas similar in other respects, all of which have a banner white or yellowish in bud and early anthesis.

When Rydberg described *Parosela botterii* and *P. atrocyanea*, he had only one collection of each for comparison, and he separated them in terms of pubescence characters which subsequent experience has shown to be unreliable. They are similar in all essential features, but do seem to differ in number and shape of leaflets, in length of calyx-teeth, and in size of the corolla. They appear, moreover, to be vicariant in range, and are treated below as geographic varieties.

Key to the Varieties of *Dalea botterii*

1. Leaflets 7–12 (13) pairs, prominently keeled dorsally; *calyx* 5.8–8.2 mm long, the dorsal tooth 3.4–5.3 mm long, 1–2.4 mm longer than the tube; *blade of the keel* ± 6.3–7.4 mm long; flanks of Mt. Orizaba n.-ward into Tamaulipas. 129a. var. *botterii*.
1. Leaflets 4–7 (8) pairs, not keeled dorsally, the costa immersed; *calyx* 4.7–6.2 mm long, the dorsal tooth 2.2–3 mm long, ± 0.3 mm longer to 0.3 mm shorter than the tube; *blade of the keel* ± 5–5.5 mm long; mountains of s. Puebla and probably adjacent Oaxaca. 129b. var. *atrocyanea*.

129a. Dalea botterii (Rydberg) Barneby var. botterii
(Plate CXIV)

Glabrous to thinly pilosulous nearly throughout, but the young branchlets nearly always pubescent, the foliage dark green, not glaucous, the leaflets thinly hairy on both sides, only beneath, or glabrous; *blades* of stipules 1.5–4.5 (5.5) mm long; *main cauline leaves* 2–3.5 cm long, the leaflets oblanceolate to oblong-oblanceolate, obtuse and gland-mucronulate to emarginate, 2.5–7 mm long; *spike* 2–7 cm long; *petals* violet-purple, usually drying rose-brown; *keel* 8.6–10.7 mm, the claws 2.6–4.7 mm, the blades 6.3–7.4 mm long; *anthers* 0.6–0.8 mm long. — Collections: 10 (i).

Brushy hillsides, stony slopes and rock-ledges in the oak-belt, and open pine-forest, without known rock-preference, 1620–3110 m (5400–10,370 ft), apparently local, on and near the crest of Sierra Madre Oriental in the latitude of Orizaba, Veracruz, and adjoining Puebla; near Miquihuana and vicinity, Tamaulipas. — Flowering July to January. — *Material*: Tamaulipas. Sa. de Guatemala, mpo Gómez Farías, *J. R. Sullivan 763* (TEX); 7 mi s.-w. of Miquihuana, *Stanford, Retherford & Northcraft 710* (F, GH, NY, UC, US); Carabanchel, *L. S. Gilbert 83* (TEX). Veracruz. Veracruz to Orizaba, *Mueller 1566* (K); Orizaba, *Bourgeau 2914* (BR, K, P); 15 mi. s. of Nogales, *R. M. King 2334* (TEX); Cumbre de Acultzingo, *Liebman 4611* (F), *Ripley & Barneby 14,740* (CAS, F, GH, MEXU, MICH, NY, UC, US). Puebla. Alta Luz, *Purpus in 1907* (UC).

Dalea botterii (Rydb.) Barneby, comb. nov., based on *Parosela botterii* (Matteo Botteri, 1808–1877) Rydb., N. Amer. Fl. **24**: 110. 1920. — "Type collected at Orizaba, Mexico, *Botteri 973*..." — Holotypus, GH! isotypus (fragm), NY!

129b. Dalea botterii (Rydberg) Barneby var. atrocyanea (Rydberg) Barneby
(Plate CXIV)

Thinly pubescent with forwardly subappressed hairs up to 0.2–0.6 mm long, the foliage when mature glaucescent, blackish when dry, the leaflets either pubescent both sides or glabrous above; *blades* of stipules 1–2.5 mm long; *main cauline leaves* 1.5–2.5 cm long, the leaflets broadly oblong-obovate, truncate or emarginate, 2–5.5 mm long; *spike* 1–4 cm long; *keel* smaller than in var. *botterii*, 7.3–7 mm, the claws ± 3 mm, the blades 5.1–5.4 mm long; *anthers* 0.6 mm long. — Collections: 3 (o).

Habitat not recorded, to be looked for in pine-oak woodland on limestone at ± 2700–3000 m (9–10,000 ft), known only from Cerro de Paxtle and Cerro de Coatepe (near San Luis Tultitlanapa) e. and s. of Tehuacán in s. Puebla (to be expected in adjoining Oaxaca). — Flowering from July onward. — *Material*: PUEBLA. Cerro de Paxtle, *Purpus 3881* (UC); Cerro de Coatepe ("Coatepec"), *Purpus 2651 in 1907* (ARIZ, UC, possibly isotypic, the number being the same, but the date different, therefore possibly topotypes).

Dalea botterii (Rydb.) Barneby var. **atrocyanea** (Rydb.) Barneby, comb. nov., based on *Parosela atrocyanea* (blue-black, of the dried petals) Rydb., N. Amer. Fl. **24**: 111. 1920. — "...in the vicinity of San Luis Tultitlanapa, Puebla, July, 1908, *Purpus 2651*..." — Holotypus, NY! isotypi, F, GH, UC, US!

130. DALEA LUTEA (Cavanilles) Willdenow
(Plate CXV)

Bushy-branching and diffusely trailing suffrutescent herbs and shrubs up to 1 m, s.-ward from s. Mexico becoming taller or weakly arborescent and up to 4 m tall, highly variable in quantity, quality, and dispersal of pubescence, sometimes glabrous to the inflorescence but the stems and leaves usually ± densely pilosulous with ascending, antrorsely subappressed, rarely erect, straight or sinuous hairs up to 0.2–0.8 (1.2) mm long, the young branches sparsely tuberculate distally, the older stems becoming grayish-brown and furrowed, the herbage varying from deep green to canescent, often discolored to blackened in drying, the leaflets equally pubescent both sides, pubescent only below, or glabrous, brighter green above, livid-tuberculate beneath; *leaf-spurs* 0.3–1.2 mm long; *stipules* narrowly subulate to subulate-attenuate or linear-caudate, 1–8 mm long, castaneous or livid becoming dry and papery, dorsally pubescent or rarely glabrous; *intrapetiolular glands* usually 0, exceptionally 1 or 2, small, black; *post-petiolular glands* prominent, conic or mammiform, black or livid; *leaves* short-petioled or subsessile, the main cauline ones 1.5–5 (7) cm long, with narrowly margined rachis and 5–10 or (in one rare var.) 9–15 pairs of oblong-obovate to broadly oblanceolate or oblong-elliptic, obtuse to deeply emarginate, flat or loosely folded leaflets up to 3–14 mm long, the leaves of axillary spurs (when present) smaller, with fewer shorter leaflets; *peduncles* (of smaller plants) all terminal to stems, but usually the first leaf-opposed and succeeding ones terminal to lateral branchlets and raised above the first, (0) 0.5–5.5 (7) cm long; *spikes* ± dense but not conelike, usually many-flowered, ovoid-pyramidal early becoming cylindroid, without petals or androecia 0.9–1.5 cm diam, the pilosulous (exceptionally glabrate) axis (1) 1.5–10 (15) cm long; *bracts* persistent (deciduous with ripe pod) ovate- to lance-acuminate or -caudate, 3–6.5 mm long, rather firm, commonly livid or black, tuberculate, dorsally pilose or glabrous, most commonly bearing a few hairs at least on keel distally and on the tail, always glabrous within; *pedicels* 0–0.3 (0.5) mm long; *calyx* (3.6) 4–7 (7.7) mm long, the tube (2.2) 2.3–2.9 (3.2) mm long, often glabrous externally or glabrescent toward the base, sometimes pilose from base upward, the ribs slender becoming prominent, usually colored, the pallid or livid-nigrescent, in age ± lustrous intervals charged with 1 row of ± 3–5 round, elliptic, or linear, black or livid blister-glands up to 0.2–1 mm diam, the plumose teeth stiffly aristate above the low-deltate to broadly triangular base, commonly gland-spurred, unequal, the dorsal

one longest, (1.3) 1.7–4.5 (5.2) mm long, (1) 0.6 mm shorter to 1.2 (2.7) mm longer than tube, in fruit divaricate and often slightly declined at tip; *petals* concolorous, pale yellow, clear lemon-yellow, or greenish-ochroleucous, at least the banner rubescent in age, the epistemonous ones either unchanged in drying or turning brownish (especially along nerves) or finally black (even before falling), the banner and keel often but not always gland-tipped, the banner-blade sometimes gland-sprinkled, the inner ones perched low on androecium (0.8–2.7 mm above hypanthium; *banner* 4.6–7.5 (8) mm long, the claw 2–4 mm, the deltate-ovate or cordate blade ± hooded at the obtuse or emarginate apex, (2.6) 2.8–4.8 mm long, 2.8–4.5 (5.4) mm wide, recessed at base into a ± pronounced cornet; *wings* 4.7–7.8 mm long, the claw 1.4–2.6 (2.8) mm, the oblong-elliptic or -obovate blade 3.3–5.2 (5.6) mm long, 1.4–2.6 (3) mm wide; *keel* 6.4–10.5 mm long, the claws 2.1–4.2 mm, the broadly obovate to obliquely long-obovate blades (4.2) 4.5–7.1 (7.3) mm long, 2.4–4 (4.5) mm wide; *androecium* 10-merous, 6.5–10 (10.5) mm long, the longer filaments free for 1.4–2.6 (3.1) mm, the tassel often but not always nigrescent; *pod* 2.4–3.1 mm long, either triangular or obovate in profile, the style-base terminal or latero-terminal, the slenderly carinate prow either straight or convexly arched, the valves hyaline at base, thinly papery, often nigrescent and charged with at least a few livid glands, densely pilosulous from middle upward or only thinly so toward the prow; *seed* 1.6–2.1 mm long.

A polymorphic species widely dispersed over much of temperate Mexico and south through the highlands of Guatemala into Honduras, *D. lutea* is subject to notable variation in stature and pubescence, but in other respects is rather uniform. The species can be separated from other yellow-flowered daleas by the combination of *persistent* bracts and a long-toothed calyx with prominent blackish glands in the intercostal panels of the tube and plumulose teeth. It is readily divided into two major branches, one adapted to the arid plateau north of the Neovolcanic Belt, the other to the oak-pine belt south of that line. These differ most obviously in stature, the former flowering as a herb or low bush little more than 1 meter tall, whereas the other becomes a tall straggling shrub or treelet that may reach a height of four meters in favorable sites. The difference in habit is correlated weakly with differences in distribution of vesture, size of stipules, and size of petals, and with a perhaps more stable one in outline of the pod. A poorly understood entity, *D. lutea* var. *arsenei*, known from two mutually remote localities at the margins of Balsas Depression, is apparently distinguished from both the preceding in the combination of many leaflets and larger flowers.

Key to the Varieties of *Dalea lutea*

1. Leaflets of primary cauline leaves 9–15 (16) pairs; local in Michoacán and Guerrero; *stems* glabrous or thinly hirsutulous and keel-blades ± 7.5 mm long. 130b. var. *arsenei*.
1. Leaflets of primary leaves 5–9 (10) pairs; range of the species, but in that of the last the stems densely shaggy-pilose and the keel-blades 4.5–6 mm long.
   2. Diffuse suffruticose perennial herbs and low bushy shrubs up to ± 1 m tall but mostly lower; *stipules* mostly 1–3, rarely 5 mm long; *pod* triangular in outline, the prow-line straight or only slightly convex in profile; *pubescence* of plant variable, but if the stems villous-pilose with erect to widely divergent hairs then definitely not more than suffruticose and the flowers relatively large (keel-blades over 6 mm long); centr. Chihuahua, n. Coahuila, and Nuevo León, s. over the plateau and along its Gulf slope to the Valley of Mexico; Puebla. 130a. var. *lutea*.

2. Shrubs and treelets 1–4 m tall (flowering precociously when suffrutescent); *stipules* (2) 2.5–6.5 (8) mm long; *pod* obovate in outline, the prow-line strongly convex; *pubescence* of stems nearly always shaggy-villous-pilose, the hairs erect or subretrorse; *flowers* small (keel-blades 4.6–6 mm long); periphery of Balsas Depression in s.-e. Jalisco, e. Michoacán and s. México; Chiapas through Guatemala into Honduras. 130c. var. *gigantea*.

130a. DALEA LUTEA (Cavanilles) Willdenow var. LUTEA
(Plate CXV)

To 1 m tall, mostly less; *stems* and foliage variably pubescent to completely glabrous, the foliage deep green (blackish when dry) to gray-silky, the leaflets when pubescent often glabrous above; *leaflets* of larger leaves mostly 3–8 (10) mm long; *spikes* (1) 1.5–10 cm long; *calyx* (3.6) 4–7 (7.7) mm long, the tube pubescent from base upward, or glabrescent at base, or glabrous and lustrous up to the plumose teeth, the dorsal tooth (1.3) 1.7–4.5 (5.2) mm long; *petals* pale but clear yellow, in age or dried bright yellow, ochroleucous tinged or veined with brown, less often nigrescent; *petals* variable in size, the keel-blades (4.2) 4.8–7 (7.3) mm long; *androecium* mostly 7.5–10 mm long. — Collections: 110 (vii).

Open brushy and thinly wooded hillsides and grassy plains, sometimes colonial along hedges or on terraced milpa, n.-ward in canyons of desert mountains, e.-ward in mesquite grassland, s.-ward entering the oak-pine belt, 750–2400 m (2500–8000 ft), most prolific on limestone bedrock but not confined to it, widespread and locally abundant through Sierra Madre Oriental from Monterrey s. to Hidalgo, on the Gulf slope extending to the piedmont and e. into Sierra de Tamaulipas, n.-w. over scattered desert mountains to Sierra del Carmen in n. Coahuila, and w. to the foot of Sierra Madre Occidental in n.-centr. Chihuahua (to nearly 30° N), thence s. over the Central Plateau to Aguas Calientes, Sierra de Guanajuato, and valley of Mexico, apparently disjunct in extreme s. Puebla. — Flowering June to November. — *Representative*: CHIHUAHUA: *Pringle 1010* (F, NY, UC); *Stewart & Johnston 2143* (GH, TEX); *Correll & Johnston 21,709* (RENNER). COAHUILA: *Stewart 1705* (GH, TEX); *Johnston 8946* (GH); *Marsh 590* (GH, OKLA, MEXU); *Johnston & Mueller 1174* (GH, MICH, TEX). NUEVO LEÓN: *Mueller 2303* (ARIZ, F, NY, OKLA, TEX); *M. Taylor 81* (ARIZ, F, NY, OKLA, UC); *Ripley & Barneby 13,550* (CAS, MEXU, NY, US). TAMAULIPAS: *von Rozynski 163* (F, NY, UC); *Stanford, Retherford & Northcraft 736* (ARIZ, NY, UC); *R. M. King 4517* (NY, US); *Dressler 2288* (MEXU, UC). DURANGO: *Gentry 6922* (F, GH, NY); *Reko 5317* (F). ZACATECAS: *Ripley & Barneby 14,141* (CAS, DS, NY, US); *Pringle 1754* (ARIZ, F, L, M, W); *Gentry 6988* (F, GH, NY). SAN LUIS POTOSÍ: *Parry & Palmer 153* (BR, F, GH, NY, WIS); *Lundell 5120* (ARIZ, F, UC, US); *Rzedowski 3104, 5246, 8461, 13,758* (ENCB). AGUAS CALIENTES: *McVaugh 23,691* (MICH, NY). GUANAJUATO: *Ripley & Barneby 13,367* (MEXU, NY, US). QUERÉTARO: *Pringle 10,027* (L, M, NY, UC, Z); *Painter & Rose 9746* (NY, US). HIDALGO: *Hartweg 282* (OXF, K, NY, W); *Pringle 6632* (M, NY, UC, US, W, Z); *Ripley & Barneby 13,604* (CAS, NY, US), *13,624* (CAS, NY). MÉXICO (Edo. and D. F.): *Bourgeau 1059* (BR, P); *Matuda 19,532, 21,732* (NY); *Rzedowski 1597* (ENCB); *Ripley & Barneby 13,381* (NY). PUEBLA: *Purpus 3882* (UC), *3213* (NY, UC).

Dalea lutea (Cav.) Willd., Sp. Pl. **3**: 1341. 1801, based on *Psoralea lutea* (yellow) Cav., Ic. **4**: 12, Pl. 325. 1797 (Sept-Dec; cf. Taxon **10**: 78). — "Habitat in Nova Hispania...Floruit in laudato horto mense Octob. 1796." — Holotypus, MA (herb. Cav., excluding small plant

labelled "Querétaro, *Née*")! isotypus, BM! — *Parosela lutea* (Cav.) Cav., Descr. Pl. 186. 1802; Rose, Contrib. U. S. Nat. Herb. **12**: 273. 1909.

Dalea ovalifolia (with oval leaflets) Ort., Dec. **1**: 30, tab. 3. 1797 (? mensis). — "Habitat in nova Hispania. Floret in Reg. Horto Matrit. mense Augusto e seminibus missis per D. Sessé." — No typus known to survive; lectotypus, the cited plate.

Dalea leucostoma (white-mouthed, of the ciliate calyx) Schlechtd., Linnaea **12**: 294. 1838. — "Pr. Regla, Oct. (C. Ehrenberg)." — No typus seen, but the detailed protologue agrees well with material from the Gulf slope in centr. Hidalgo. — *Parosela leucostoma* (Schlechtd.) Rose, Contrib. U. S. Nat. Herb. **10**: 106. 1906.

Dalea plumosa (feathered, of the calyx-teeth) Wats., Proc. Amer. Acad. **21**: 448. 1886. — "In the shade of cliffs near Chihuahua; C. G. Pringle, October, 1885 (n. 621)." — Holotypus, GH! isotypi, BR, NY, US, W! — *Parosela plumosa* (Wats.) Rose, Contrib. U. S. Nat. Herb. **10**: 106. 1906.

Parosela painteri (Joseph Hannum Painter, 1879–1908) Rose, Contrib. U. S. Nat. Herb. **10**: 105. 1906. — "Type...collected by J. N. Rose and Jos. H. Painter on a stony hillside near San Juan del Rio, Queretaro, August 18, 1905 (no. 9526)." — Holotypus, US! isotypi, MEXU, NY! — *Dalea painteri* (Rose) Bullock, Kew Bull. **1939**: 197. 1939.

Parosela wardii (Lester Frank Ward, 1841–1913) Rydb., N. Amer. Fl. **24**: 112, exclus. syn. 1920. — "Type collected at San Luis Potosi, September, 1891, *Lester F. Ward...*" — Holotypus, US!

Parosela caudata (tailed, of the bracts) Rydb., N. Amer. Fl. **24**: 112. 1920. — "Type collected at Alvarez, San Luis Potosi, September 5–10, 1902, *Edward Palmer 110...*" — Holotypus, US! isotypus, NY! — *Parosela lutea* var. *caudata* (Rydb.) Macbr., Contrib. Gray Herb., New Ser. **65**: 21. 1922. *Dalea caudata* (Rydb.) Bullock, Kew Bull. **1939**: 195. 1939.

Parosela argyrostachya sensu Rydb., N. Amer. Fl. **24**: 110. 1920, exclus. basonym.

Parosela macrostachya sensu Rydb., N. Amer. Fl. **24**: 110. 1920, exclus. basonym.

This is the common yellow-flowered dalea of the Mexican Plateau, known in Tamaulipas, Nuevo León, Coahuila, and probably elsewhere as *Ramón* or *Escobita de Ramón*, in Hidalgo sometimes as *Anicillo*. Unlike those of most yellow-petalled species, the petals often retain much of their color in fading, the banner, however, always early rubescent and the wings and keel often becoming brown-veined. It differs from the rarer, marginally sympatric *D. capitata* in its more numerous (5–10 not 3–5) pairs of generally expanded and thin-textured leaflets and in the aristiform tips of the calyx-teeth, these almost always longer than the tube; and from the more closely related *D. melantha*, which has a similar calyx, in the persistent interfloral bracts.

Variation in var. *lutea* finds expression in stature and growth-habit, in density and dispersal of trichomes on leaves and calyx, in length of bracts and flower-parts, and in development of glands, whether on the panels of the calyx-tube, or as spurs on the calyx-teeth, or as blisters terminal to the midvein of banner and keel. The region in which var. *lutea* is most abundant lies within and on both slopes of Sierra Madre Oriental, from Monterrey into Hidalgo, and onward into the Valley of Mexico. Here the average plant has moderately pubescent leaves and stems, a calyx-tube at least thinly hairy below the orifice, relatively small (to 0.45 mm) intercostal glands, and spurless calyx-teeth. The latter, however, vary greatly in length, often in company with bracts and sometimes with stipules, the divaricate dorsal teeth and the bract-tails when long giving the spike a distinct teasel-like appearance. From San Luis Potosí northward the prevailing habit is diffuse and scarcely suffruticose, and the flower is relatively small, with glandless keel-blade ± 5–6 mm long; in Hidalgo and southward the plants become distinctly shrubby when adult and the flower is often larger, with gland-tipped keel 6–7 mm long. These contrasts would suggest the possibility of separating from typical southern var. *lutea* a northern segregate corresponding with *Parosela wardii* and *P. caudata* (the minor variant with long-tailed

bracts), but occasional large-flowered individuals are found as far north as Monterrey (*Edwards s. n.*, NY) and a small, glandless keel as far south as Hidalgo and México (*Matuda 4865*, *Hartweg 282*, NY). Sporadically within this range and west to Zacatecas (*Gentry 6988*, NY) occurs a densely and loosely pilose phase, the gray or silvery pubescence extending upward from stems and foliage to the bracts and calyx-tube; this, corresponding with the original *Psoralea lutea* Cav. lacks differential characters correlated with pubescence, and seems clearly to represent no more than a minor variant.

Westward toward the foothills of the Western Sierra, in the dry grasslands of the Central Plateau, var. *lutea* presents a series of glabrescent or truly glabrous forms, differing from their eastern kindred in having a glabrous calyx-tube charged with larger, sometimes confluent glands up to 0.5–1 mm diameter. Except that the calyx-teeth are here more prominently spurred, reflecting a greater development of glands in the tube, the flower is essentially identical with that of large-flowered var. *lutea* from Hidalgo and Mexico. The variant truly glabrous to the spikes, corresponding with *Parosela argyrostachya* sensu Rydb. (but not the true *D. argyrostachya* H. & A.), and its thinly pilosulous twin described as *D. plumosa* Wats. might be interpreted as a geographic variety, except for the existence in Querétaro and México of plants combining large glands with both large and small keel-petals and a calyx-tube either glabrous below the teeth or partly hairy. These intermediate forms, among them the type-collection of *Parosela painteri*, provide all the necessary transitional steps between the most nearly glabrous and most densely pubescent aspects of var. *lutea*. Moreover a fully glabrous form has been collected far out on Sierra de Tamaulipas, at the point furthest in the range of var. *lutea* from the focus of glabrescent phases on the Central Plateau.

The modes of variation described in the foregoing paragraphs act independently of each other, yielding in a variety of combinations a number of individually distinct forms. Upon close examination these are found to stand away from the rest only in a particular combination of characters each of which is known to be inconstant elsewhere in the species. Most of the names listed in the synonymy of var. *lutea* were applied in the first instance to such individual variants.

It is possible that the earliest name for *D. lutea* is really *D. ovalifolia*. Cavanilles and Gómez-Ortega independently described the same plant growing in the Madrid garden from seed sent home by Sessé. Ortega's specimen was said to be in flower in August, that of Cavanilles in October of 1796, and both descriptions appeared during the course of the following year. The description of Cavanilles has been dated to the last quarter of 1797; the precise date of Ortega's is unknown. By 1802 Cavanilles (Descr. Pl. 186) transferred *D. ovalifolia* to the synonymy of his own *Parosela lutea* and this synonymy, not necessarily reflecting the facts of priority, has been accepted universally since. Unless and until the contrary can be demonstrated, tradition is best followed.

130b. DALEA LUTEA (Cavanilles) Willdenow var. ARSENEI (Macbride) Barneby

Apparently shrubby, but stature unknown; *stems* and nigrescent foliage either glabrous or thinly hirsute with weak spreading hairs up to ± 1.4 mm long; *primary cauline leaves* up to 4.5–7 cm long, with 9–15 (16) pairs of leaflets; *spikes* 2.5–10 cm long; *calyx* thinly pilose distally, the gland in the intercostal membranes 3–5, small, not very prominent; *flowers* large, the calyx 5.7–6.5 mm, its tube 2.8–3 mm, the dorsal tooth 2.7–3.7 mm long; *banner* 7–7.3 mm long; *wings* 7.2–7.5 mm long; *keel* 10–11 mm long, the claws 3.6–4 mm, the blades 7.3–7.7 mm long, 4–4.3 mm wide; *androecium* 10–11 mm long. — Collections: 3 (o).

Habitat not recorded, but to be sought in the oak-pine belt at ± 1650–1950 m (5500–6500 ft), known only from two disconnected regions in s. Mexico: mountains e. of Morelia, e. Michoacán; and on n. slope of Sierra Madre del Sur in e.-centr. Guerrero. — Flowering August to January. — *Material*: MICHOACÁN: route de Mexico, près Morelia, *Arsène 5696* (US). GUERRERO: Ayotsinapa to Petatlán, *E. W. Nelson 2147* (NY).

Dalea lutea (Cav.) Willd. var. **arsenei** (Macbr.) Barneby, stat. nov., based on *Parosela arsenei* (Arsène Gustave Joseph Brouard, Bro. Gerfroy Arsène, F.S.C., 1867–1938) Macbride, Contrib. Gray Herb., New Ser. **65**: 21. 1922. — "Mexico: vicinity of Morelia, Michoacan, *Arsene 5596*..." — Holotypus, from "nord du Zapote, 1950 m., août 4, 1910", GH! isotypus, US!

The existence in the Transverse Volcanic Belt of eastern Michoacán, close to populations of characteristic var. *gigantea*, of a second, genetically independent race of *D. lutea* is hardly credible unless the type-locality is at the edge of a more continuous range connecting it, perhaps through Sierra Madre del Sur, with the one other known locality in Guerrero. For the present it seems impossible to assimilate the three collections cited into var. *gigantea*, of which all other Mexican collections have at once fewer leaflets, densely shaggy-pilosulous young stems, and substantially smaller flowers.

130c. DALEA LUTEA (Cavanilles) Willdenow var. GIGANTEA (Rose) Barneby
(Plate CXV)

Shrubby or arborescent when adult, up to 1–4 m tall, but precociously flowering as a monopodial, suffrutescent herb; *stems* and foliage always pubescent, the young branches densely shaggy-hirsutulous with subhorizontal, straight or wavy hairs up to 0.6–1 mm long, the leaflets more thinly so, nigrescent in drying; *leaflets* of primary leaves (4) 5–10 (14) mm long; *spikes* 2–15 cm long; *calyx* 4.4–6.2 mm long, the tube glabrous externally, the dorsal tooth 2–3.2 mm long; *petals* opening greenish-cream, early turning greenish-brown or black, relatively small, the keel-blades (4.6) 5–6 mm long; *androecium* ± 6.5–8.5 mm long. — Collections: 32 (iii).

Brushy and openly wooded hill country, often in oak or oak-pine woodland, sometimes persisting in grassland successional to cut-over forest, in more mesic sites than var. *lutea*, 1100–2200 (in Guatemala reportedly 3000) m, of bicentric dispersal: s. slope of Neovolcanic Belt in s.-e. Jalisco, e. Michoacán and s.-e. México; also in highland Chiapas and locally abundant through s. Guatemala into Intibucá, Honduras. — Flowering August to December. — *Representative*: MEXICO. JALISCO: *Faberge s. n.*, from Sayula (TEX). MICHOACÁN: *Pringle 13,517* (ARIZ, M); *Ripley & Barneby 14,818* (CAS, DAO, NY). MÉXICO: *Matuda 27,110* (MEXU, NY); *Hinton 875* (MEXU, NY); *Ripley & Barneby 14,867* (DAO, NY, US). CHIAPAS: *Ghiesbreght 581* (NY); *Breedlove 9742, 13,749* (US). GUATEMALA. HUEHUETENANGO: *Standley 65,671* (F, NY); *Steyermark 50,342* (F). EL QUICHÉ: *Aguilar 840* (F). QUETZALTENANGO: *Standley 83,889* (F). SOLOLÁ: *Williams & Molina 27,261* (NY). CHIMALTENANGO: *Standley 61,622* (F). SACATEPÉQUEZ: *Standley 61,251* (F, NY). ESCUINTLA: *Aguilar 1756* (F). GUATEMALA: *Molina et al. 15,963* (NY). JALAPA: *Steyermark 32,297* (F, see discussion below). HONDURAS. INTIBUCÁ: *Molina 8738* (NY).

Dalea lutea (Cav.) Willd. var. **gigantea** (Rose) Barneby, stat. nov., based on *Parosela gigantea* (immense, of the great stature) Rose ex Rydb., N. Amer. Fl. **24**: 110. 1920. — "Type collected at Tarascon, Michoacan, October 11, 1904, *Pringle 8848*..." — Holotypus,

US! isotypi, GH, K, L, M, MEXU, NY, UC, W, Z! — *Dalea gigantea* (Rose) Bullock, Kew Bull. **1939**: 196. 1939.

Dalea cinerea Moric. ex Micheli ap. Donn. Sm., Bot. Gaz. **20**: 283. 1895. — "Santiago, Depart. Zacatepequez, Guat., alt. 6,500 ft., 1891, Rosalio Gomez, no 999. — Embaulada, Depart. Zacatepequez, Guat., alt. 5,500 ft., Dec. 1889, Heyde & Lux, no., 4,465." — Lectoholotypus, *Gómez in Donnell Smith 999*, US!

An untidy shrub or treelet of irregular growth and rather squalid mien, the small ochroleucous flowers early turning brown or black, the filament-tassel and anthers also blackish. Herbarium specimens of var. *gigantea*, provided the origin is known, are readily distinguished from other daleas with yellow, nigrescent petals by the combination of long, narrow spikes and persistent interfloral bracts. Locality data are virtually essential for secure separation of some flowering specimens of var. *gigantea* and small-flowered, pubescent phases of var. *lutea*. The latter has petals often of a brighter yellow and pods at once more densely pubescent and more sharply triangular in profile view, but the latter are lacking, of course, in young material, and color is not really reliable. In the field var. *gigantea* is recognized as different chiefly because of its great stature, but branchlets separated from the trunk simulate and could pass for whole stems of var. *lutea*. While the calyx-tube of var. *lutea* is only sometimes glabrous, this is the rule in var. *gigantea*.

A field note accompanying the collection cited above from Jalapa, Guatemala, describes the "upper flowers pale lilac, older ones turning dark purple," but the petals when dried are not different from those of other var. *gigantea*. The point requires confirmation, especially for the bearing it may have on the status of *D. botterii*, which could be interpreted as a purple-flowered *D. lutea* var. *lutea*.

The essential similarity between the suffruticose northern and subarborescent southern phases of *D. lutea* has repercussions in the story of *D. cinerea*, listed above in synonymy of var. *gigantea*. The epithet was first applied by Moricand to specimens collected at San Carlos, Tamaulipas, by Berlandier (K, NY ex herb. Meissn., this a gift from Moricand) which represent a small-flowered variant of var. *lutea*. Hemsley (1880, p. 238) listed the Kew duplicate under the nomen nudum *D. cinerea* Moric. and associated with it *Ghiesbreght 581* from Chiapas, a specimen of var. *gigantea*. When Micheli came to describe *D. cinerea* formally, the element of var. *lutea* dropped out of sight, and Moricand's epithet was transferred to what is here called var. *gigantea*. Rydberg (1920, p. 112) wrongly referred *D. cinerea* (in part) to synonymy of his own *Parosela wardii* and failed to mention the excluded element under *P. gigantea*. The epithet obviously belongs to one of these, and antedates both. If var. *gigantea* as described herein should ever be separated from var. *lutea* at the level of species, it must inherit the name *D. cinerea* Moric. ex Micheli.

131. DALEA MELANTHA Schauer
(Plates CXVI, CXVII)

Slender erect shrubs 0.6–2 (at anthesis commonly 1–1.5) m tall, the old wood furrowed and striped, the flexuous young branchlets usually livid or castaneous, smooth or only remotely and inconspicuously tuberculate, usually glabrous to the inflorescence but in a rare var. the foliage gray-silky with subappressed hairs up to 0.2–0.3 mm long, the leaflets of thick texture, usually becoming livid or black when dried, smooth above, punctate beneath; *leaf-spurs* 0.6–1.2 (1.4) mm long; *stipules* narrowly triangular or subulate, livid or brownish, 0.6–2 (2.5) mm long; *intrapetiolular glands* small or confluent into 1, sometimes 0; *post-petiolular glands* large, conic, black or livid; *leaves* short-petioled, ± dimorphic, the primary cauline ones (drought-deciduous) 1–2.5 (3) cm long, with margined, often sparsely punctate rachis and 2–6 (if pubescent 7–10) pairs of oblanceolate to obovate or obovate-cuneate, obtuse

or emarginate but often gland-mucronate, flat or loosely folded leaflets 2–5 (7) mm long, the leaves of axillary short-shoots shorter, with fewer (mostly 5–7) smaller leaflets; *spikes* leaf-opposed and terminal to some lateral branchlets, often technically racemose, either sessile or pedunculate, the peduncles of the lowest and largest up to 2–4 (5) cm long, the flowers moderately dense or loose and open, when pressed not concealing the villosulous axis, in outline ovoid becoming oblong, without petals (10) 12–16 mm diam, the villosulous axis finally (0.5) 1–5 (6) cm long; *bracts* early deciduous, lance- or ovate-acuminate, (2) 2.5–5 (6.5) mm long, boat-shaped below the middle, dorsally livid or livid-green and charged with a few large glands, either villosulous dorsally from base upward or glabrate medially and distally, either glabrous or pubescent within; *pedicels* (0) 0.1–1 mm long; *calyx* (4.7) 5.6–9.2 mm long, villous from base upward with fine spiral hairs up to (0.7) 1–1.4 mm long or the tube exceptionally glabrous, the teeth always plumose, the tube (2.5) 2.6–3.6 mm long, the ribs becoming thick and prominent, the firm, livid or pallid intervals charged with ± 5 prominent, dark orange or blackish blister-glands, the teeth triangular-aristiform, gland-spurred, spreading in age, the dorsal one a little longer than the rest, (2.2) 3.2–5.6 mm long, usually longer, rarely a little shorter than tube; *petals* pale greenish-yellow turning chocolate purple, brown, or black, usually all gland-tipped, the banner often and the keel sometimes charged with a few scattered glands, the epistemonous petals inserted low on the androecium (0.8–1.7 mm above hypanthium); *banner* 4.8–7.6 mm long, the subcarnosulous claw 2.4–3.8 mm long, the deltate- or ovate-cordate blade 2.6–4.4 mm long, (3) 3.2–5.5 mm wide, recessed at base into a shallow cornet and the basal lobes incurved and adherent, forming lateral pockets; *wings* 6–7.4 mm long, the claw 1.8–2.7 mm, the oblong-oblanceolate blade 4.2–5.2 mm long, 2.2–3.2 mm wide; *keel* 7–9.2 mm long, the claws 2.7–4.2 mm, the broadly obovate blades 5–6.2 mm long, 3.1–4.2 mm wide; *androecium* 10-merous, 7–9.5 mm long, the longer filaments free for ± 2.5–2.9 mm, the connective gland-tipped, the anthers 0.6–0.8 mm long; *pod* (little known) 3.2–3.5 mm long, triangular in profile, the style-base latero-terminal, the prow prominulous, slender but cordlike, the valves hyaline in lower ⅓, papery, pilosulous and charged with a few livid glands distally; *seed* up to 2.3 mm long.

Graceful but inconspicuous, sparsely leafy shrubs with furrowed, alternately pale- and dark-striped bark, pliant livid twigs, proportionately large heads of plumose, long-toothed calyces, and pale greenish-yellow petals that quickly fade brown or black. The species as a whole is distinguished from the *Thyrsiflorae* by its comparatively few and large spiciform racemes, the flowers being in nearly all populations distinctly pedicellate; and more securely from all forms of the polymorphic *D. lutea* by the precociously deciduous bracts, thrown off before the petals expand. The species has a rather uniform and characteristic habit easily recognized in the field, but is variable in detail of leaves, pubescence, and proportions of the calyx. Four varieties, one strongly and two weakly differentiated from the typical, are recognized.

Key to the Varieties of *Dalea melantha*

1. Leaflets of primary cauline leaves 2–6 pairs; *interfloral bracts* glabrous internally; *leaflets* glabrous except in var. *pubens*, local in s.-w. Coahuila.
   2. Foliage glabrous; s.-e. Coahuila e.- and s.-ward.

3. Leaflets (of primary leaves) 3–6 pairs, oblong-oblanceolate to narrowly obovate-cuneate and emarginate but then small, mostly less than 4.5 mm long; *racemes* relatively compact, the calyces subcontiguous when pressed; extreme s.-e. Coahuila to Oaxaca, but rare in the range of the next.
131a. var. *melantha*.

3. Leaflets 2–3 pairs, cuneate-obcordate, the larger ones often up to 5–7 mm long; *racemes* loose, the calyces separated by spaces of ± their own width; local in s.-e. Coahuila, w.-centr. Tamaulipas, and adjoining San Luis Potosí. 131b. var. *berlandieri*.

2. Foliage and stems softly puberulent throughout; s.-w. Coahuila. Leaflets in size and number as var. *melantha*, but lax racemes of var. *berlandieri*.
131c. var. *pubens*.

1. Leaflets of primary cauline leaves 7–9 pairs; *interfloral bracts* silky-pubescent within. Plant pubescent throughout, the leaves softly gray-silky; racemes of var. *berlandieri*. Local in Sierra Madre of extreme n. Oaxaca.
131d. var. *cineracea*.

131a. DALEA MELANTHA Schauer var. MELANTHA
(Plate CXVI)

Glabrous to the spikes (the young twigs exceptionally puberulent, but the leaflets glabrous); *leaflets* mostly small, up to 5 mm long, if obcordate at least 5 pairs in some primary leaves; *spikes* mostly compact, the flowers subcontiguous along the axis; *pedicels* mostly 0.2–0.5 mm long; $2n = 7_{II}$, 14 (Mosquin). — Collections: 40 (vi).

Arid rocky or sandy-clay hillsides, becoming abundant on gullied badlands subject to active erosion, on a variety of soils, but from Hidalgo n.-ward notably calciphile, s.-ward on limestone, shaley clays, andesite, and pumice, 1380–2400 m (4600–8000 ft), widespread along the e. side of the Mexican Plateau from n.-centr. Oaxaca n. to centr. San Luis Potosí, there entering the range of the next but known from scattered stations as far n. as extreme s.-e. Coahuila and adjoining Nuevo León. — Flowering July to March, perhaps almost through the year. — *Representative*: COAHUILA. Arteaga: typus of *P. fuscescens*. NUEVO LEÓN. Galeana: *C. & H. Mueller 323* (F, NY, US). SAN LUIS POTOSÍ. Catorce: *Rzedowski 8166* (ENCB). Charcas: *Rzedowski 8818* (ENCB). Ciudad del Maíz: *Purpus 5192* (F, UC, US). Guadalcázar: *Ripley & Barneby 13,777* (NY); typus of *D. guadalcazarensis*. Cerro de San Pedro: *Rzedowski 7856* (ENCB). Santa Catarina: *Rzedowski 3593* (ENCB). San Nicolás Tolentino: *Rzedowski 11,315* (ENCB). QUERÉTARO. Tolimán: *Rzedowski 26959* (ENCB). HIDALGO. Zimapán: *González-Quintero 3297* (ENCB). Cardonal: *González-Quintero 2078* (ENCB). Ixmiquilpan: *Purpus 1376* (F, NY, UC). PUEBLA. Tepeyahualco: *Prince Paul of Würtemburg in 1830* (M). Aljojuca: *Ripley & Barneby 14,745* (MEXU, NY, US). Esperanza: *Balls 5416*. Santiago Miahuatlán: *Ripley & Barneby 14,737* (CAS, NY). Tehuacán: *Purpus 5653* (UC). Coxcatlán: *Purpus 4148* (UC). Zapotitlán: *Ripley & Barneby 14,710* (DAO, NY, US). OAXACA. Nochixtlán: *Ripley & Barneby 13,668* (CAS, MEXU, NY, US), *14,585* (CAS, NY).

Dalea melantha (black-flowered, the petals early nigrescent) Schauer, Linnaea **20**: 746. 1847. — "In Mexici provincia Oaxacana. *Aschb. n.* 204." — Holotypus, presumably lost at B, but the protologue decisive. — *Parosela melantha* (Schauer) Rydb., N. Amer. Fl. **24**: 108. 1920.

Parosela fuscescens (turning brown, of the petals) Rydb., N. Amer. Fl. **24**: 109. 1920. — "Type collected in Coahuila, in 1880, *Edward Palmer 209...*" — Holotypus, US! isotypus, labelled "Sierra Madre 12–14 leagues s. of Saltillo" = probably near San Antonio de las Alanzanes, NY! — *Dalea fuscescens* (Rydb.) Rzedowski, Ciencia (Mex.) **15**: 93. 1955.

Dalea guadalcazarensis (of Guadalcázar) Rzedowski, Ciencia (Mex.) **15**: 92. 1955. — "Tipo...*Rzedowski 4911*, col. 1. X. 1954, ladera caliza, ± 10 km al oeste de Guadalcázar, S. L. P., alt. ± 1600 m." — Holotypus, MEXU!

The var. *melantha* is rather uniform in aspect but variable in detail and subject in some degree to seasonal dimorphism. Rydberg's concept of *P. melantha* was formed from study of specimens collected in July and August, at a time when the marjoity of flowering spikes present on the plant are depauperate, subsessile, and terminal to short-shoots. The normal winter phase, with fewer and at least some pedunculate, many-flowered heads appears in *North American Flora* as *P. fuscescens*, the typus of which was collected in March. Macbride (1922, p. 20) early voiced the suspicion that these two *Paroselae* were one and the same, and there is now abundant evidence that such is the case. In the southern half of its range var. *melantha* varies little, but northward from northern Puebla individual plants (or colonies of the same) aberrant in one or more characters become increasingly frequent, some of them suggesting passage into the more northern var. *berlandieri*. Noteworthy minor variants are: calyx-teeth shorter than tube (*Rzedowski 8818*); calyx-tube glabrous externally (*Purpus 4836*); as the last, accompanied by ± 4 pairs of relatively ample, obcordate leaflets (*Rzedowski 11,315*). At Minas de San Rafael (mpo. Cd del Maíz, San Luis Potosí) Purpus collected in the same season (Nov, 1910) specimens typical of var. *melantha* (no. *4638*, UC) and others typical of var. *berlandieri* (*4841*, F, UC); it is not known whether these are ecologically segregated where they occur together.

Typical *D. melantha* was collected first in late XVIII century by Sessé or his associates (Herb. *S. & M. 2668*, F, MA), and therefore could well have reached the Lambert Herbarium by way of Pavón. It has not, however, been identified with any of George Don's still ambiguous propositions derived from these sources.

131b. Dalea melantha Schauer var. berlandieri (A. Gray) Barneby
(Plate CXVII)

Habitally like var. *melantha*, differing in the associated characters of few (2 or 3 pairs) leaflets of cuneate-obcordate outline and loose, open racemes of flowers. — Collections: 12 (i).

Open rocky hillsides and rock-ledges in canyons, strongly calciphile, ± 1000–2000 m, local in s.-e. Coahuila (Sierras de Parras and Pata Galana), centr. Tamaulipas (in Sierra Madre and Sierra de Tamaulipas), and centr. San Luis Potosí. — Flowering primarily November to March, perhaps through the year. — *Representative*: Coahuila. Parras: *Purpus 1069* (F, NY, UC); *Ripley & Barneby 13,515* (CAS, NY, MEXU, MICH, US). Tamaulipas. Miquihuana: *Stanford, Retherford & Northcraft 2380a* (US). Jaumave: *von Roszynski 315, 409* (F). San Carlos: typus. San Luis Potosí. Ciudad del Maíz: *Purpus 4841* (F, UC). Soledad: *Rzedowski 6287* (ENCB).

Dalea melantha Schauer var. **berlandieri** (A. Gray) Barneby, stat. nov., based on *D. berlandieri* (Jean Louis Berlandier, d. 1851) A. Gray, Proc. Amer. Acad. **5**: 177. 1861. — "In the mountains near San Carlos, Tamaulipas, Berlandier coll. 942, 2372." — Holotypus (*Berlandier 942 = 2372*!), collected in Nov, 1831, GH! — *Parosela berlandierei* (A. Gray) Rose, Contrib. U. S. Nat. Herb. **10**: 106. 1906.

Because of the more pronounced development of pedicels in the specimens available at the time, *P. berlandieri* was misinterpreted by Rydberg as related to *D. filiciformis* and referred to subgen. *Trichopodium*, far distant from its close relatives in subgen. *Euparosela* (cf. Rydberg, 1919, p. 62; 1920, p. 108). Its status as even varietally distinct from var. *melantha* is questionable, the differential characters being feeble in themselves and poorly correlated, and the separation of the ranges imperfect. As seen in Sierra de Parras, where the plants grew on ledges of cliffs in a box-canyon, the variety appeared very different from ordinary var. *melantha* in Hidalgo southward, remarkable for the few, cuneate-obocordate leaflets and loosely racemose flowers. It seems hardly possible to stretch the concept of var. *melantha* to embrace the extreme variation in these directions.

131c. Dalea melantha Schauer var. pubens Barneby

Like var. *melantha* in size, shape and number of leaflets, but these, like the young branchlets, softly puberulent with subappressed hairs 0.2–0.4 mm; raceme lax, as in var. *berlandieri*. — Collection: 1 (typus).

In grassland-chaparral on limestone, ± 2250 m, known only from the type-locality in Sa. de Jimulco in extreme s.-w. corner of Coahuila. — Flowering in September.

Dalea melantha Schauer var. **pubens** Barneby, var. nov., foliolis parvis obovatis 4–5-jugis var. *melantham*, racemo dissitifloro var. *berlandieri* simulans, ab ambabus foliis ramulisque undique puberulis recedens, a var. *cineracea*, pube simili, foliolis 4–5- nec 7–10-jugis, bracteis intus sericeis, patriaque procul aliena distans. — Coahuila: limestone-loam flat on broad ridge in grassland-chaparral at 7500 ft., Sierra de Jimulco ± 6 (air) miles s.-s.-w. of La Rosita on trail to summit, near 25° 10′ N, 103° 15′ W, Sept. 8, 1973, *James Henrickson 13140*. Holotypus, TEX.

A remarkable variant, combining in one plant the 4–5 pairs of small leaflets expected in var. *melantha*, the lax raceme of var. *berlandieri*, and the pubescence, though less dense, of the distantly allopatric var. *cineracea*. The plant suggests a laxly racemose form of *D. lutea*, but the promptly deciduous bracts and pedicellate calyces are characteristic of *D. melantha* sens. lat.

131d. Dalea melantha Schauer var. cineracea Barneby
(Plate CXVII)

Like var. *melantha* in habit, but differing in the gray-silky leaves, more numerous leaflets, and internally silky bracts. — Collection: 1 (typus).

Ledges of andesitic cliff-face, ± 1830 m (6100 ft), known only from near the crest of Sierra Madre Oriental in n. Oaxaca. — Flowering in November and doubtless through the winter.

Dalea melantha Schauer var. **cineracea** (ashen, of the leaves) Barneby, var. nov., a var. *melantha* foliis utrinque griseo-villosulis, foliolis foliorum caulinorum majorum 7–10 (nec 2–6)-jugis, bracteisque interfloralibus intus pilosulis nec glabris absimilis. — Oaxaca: rock-ledges in the oak-belt, mountains e. of Teotitlán del Camino, Nov 18, 1966, *Ripley & Barneby 14,727*. — Holotypus, NY; isotypi, CAS, MEXU.

The combination of many leaflets and gray pubescence sets var. *cineracea* well apart from var. *melantha*, and the internally silky bracts provide an additional differential char-

acter. In the type-locality the plants formed virgate shrubs up to about 2 m tall, starting out of chinks and fissures of a cliff face, accessible only at risk of life and limb. The flowers are almost sessile, as sometimes in var. *melantha*. The variety differs from all forms of *D. lutea* in the deciduous bracts.

132. Dalea versicolor Zuccarini
(Plates CXVIII–CXXI)

Suffrutescent becoming shrubby, monopodial or polypodial, 2–20 dm tall, with slender but wiry, virgately erect or assurgent, when tall pliantly bending, more rarely diffuse or (in exposed places) depressed and humifuse, when old gray and ± suberous stems, either paniculately or irregularly branching distally, the young branchlets castaneous or purplish, smooth or distantly gland-verruculose toward the heads, varying like the foliage from glabrous to pilosulous, the leaves dimorphic, the primary ones longer and more complex than those of leafy axillary spurs developing late in season, the leaflets green, gray, or silvery, always punctate beneath, sometimes densely minutely gland-sprinkled above; *leaf-spurs* 0.5–1.7 (2) mm long; *stipules* commonly livid or castaneous, narrowly lance-caudate to subulate, linear-caudate, or subsetiform, when long becoming dry and fragile in age, 1–6 mm long; *intrapetiolular glands* 0, 1, or 2; *post-petiolular glands* always prominent, black or orange, conic or prickle-shaped; *leaves* subsessile or short-petioled, the primary (drought-deciduous) cauline ones 1–4 cm long, with variably margined, ventrally grooved or ventrally carinate, sparsely punctate rachis and (3) 4–17 (18) pairs of oblanceolate, oblong-elliptic, obovate, obovate-cuneate, or linear-oblong, subacute to emarginate but nearly always bluntly gland-mucronate, flat or shallowly cymbiform, rarely folded, submembranous to subcarnosulous leaflets 1–7.5 (9) mm long, the leaves of axillary spurs or those subtending the spikes shorter and simpler; *peduncles* mostly terminal to branchlets, the first of each main stem-axis often leaf-opposed and up to 7 (10) cm long but mostly less, the rest shorter or obsolete; *spikes* often racemiform, moderately dense, the larger earlier ones commonly oblong-cylindroid, the later ones ovoid to capitate or subglobose, the densely pilosulous axis becoming 0.5–11 cm long; *bracts* deciduous, lance-acuminate to narrowly lance- or linear-caudate, (2.5) 3–7.5 mm long, dorsally brown or castaneous, gross-glandular, and ± densely pilose, the tips sometimes glabrate, the margins plumose-ciliate, glabrous within; *pedicels* 0–1 mm long; *calyx* densely pilose with silky, at first ascending finally spreading spiral hairs up to (0.6) 0.8–1.4 mm long, the tube (2.1) 2.4–3.5 mm long, ± oblique at orifice, the dorsal sinus sometimes shallowly recessed behind banner, the commonly golden-brown or castaneous ribs becoming thick and prominent, the intervals charged with one row of 3–6 small and pale or larger and orange or black glands, the teeth broadly to narrowly triangular at base and drawn out into laterally spurred, gland-tipped aristiform tips, the dorsal one usually longer than the rest, (2.3) 2.6–5 mm long, with very rare exceptions as long or (most often) decisively longer than tube; *petals* bicolored, the banner cream-colored or pale yellow, early rubescent, nearly always gland-sprinkled near and above the greenish eye-spot, like the keel and often the wings also tipped with a large elliptic blister-gland, the epistemonous ones pale lavender to bright rosy-purple, dull purplish-violet, exceptionally almost white, perched much below middle of androecium (mostly not over 3 mm distant from hypanthium); *banner* (4.8) 5–8.2 mm long, the claw (2.2) 2.5–4.1 mm, the deltate-cordate, ± hooded blade (2.4)

2.8–4.6 mm long, 3–5.2 mm wide; *wings* (4.8) 5–9.2 mm long, the claw (1.3) 1.5–3.2 mm, the oblong or elliptic blade (3.7) 4–6.5 mm long, 1.7–3.3 mm wide; *keel* (6.4) 6.8–11.5 mm long, the claws (2.1) 2.5–4 (4.8) mm, the broadly oval-obovate blades (4) 4.4–7 (7.5) mm long, 2.7–4.2 mm wide; *androecium* 10-merous, 7–10.5 (12) mm long, the longest free for 1.8–3.2 mm, the connective gland-tipped, the anthers 0.5–0.85 mm long; *pod* (poorly known) obtusely deltate in profile, ± 2.4–2.9 mm long, the slightly convex prow prominent but filiform, the valves hyaline in lower ⅓, thence thinly papery, charged with a few castaneous or blackish glands, pilosulous distally; *seed* (1.4) 1.6–2 mm long.

A species of immense range and wide morphological diversity, rich in minor variants of habit and vesture, but relatively uniform in structure of the long-toothed, silky-pilose calyx and prominently gland-tipped petals. Other North American daleas with long-toothed, plumose calyx differ in one or more of these characters: petals yellow; leaflets fewer; interfloral bracts persistent.

The taxonomic problems inherent in *D. versicolor* sens. lat. are complicated by seasonal dimorphism; the autumnal phase with flowers and primary stem leaves coinciding is often deceptively unlike that assumed by the same plant in late winter or spring, after the primary leaves have disjointed and short-shoots issuing from their axils have taken their place. A case of this sort is illustrated in the accompanying plate (Pl. CXX) of *D. versicolor* var. *argyrostachya*. As in the related *D. lutea* there is a marked instability in pubescence of the foliage, which may be permanently dense and silky, lacking from the upper face of leaflets but persistent on the lower, lacking from primary leaves but present on leaves of the second order, or absent altogether below the always barbate spikes. In each variety the calyx varies from sessile to distinctly pedicelled, in apparently random fashion.

The group of entities united here under the heading of *D. versicolor* have been studied in their entirety by Rydberg (1920), in part by Macbride (1922, essentially a commentary on Rydberg's monograph of 1920), and in part by Gentry (1950). The first two authors, working from herbarium material alone, failed to appreciate the importance of seasonal dimorphism and could hardly guess at the fallibility of pubescence, although this is now firmly established. Gentry's revision is far more sophisticated and penetrating, the work of a man intimately acquainted with the living plants and their environment. Its limitation is geographical, for Gentry considered only those elements of the *D. versicolor* complex native to the arid grasslands of north-central Mexico and to Sierra Madre Occidental in the wider sense. Continuing study and acquisition of new material has scarcely modified Gentry's concepts of the entities present in the area that he studied intensively, but has thrown a new light on wider problems of kinship within a group which extends far south and east in Mexico and on into the highlands of southern Guatemala. Gentry's paper remains, nevertheless, a milestone in the taxonomy of *Dalea* for its perceptive commentary on the life-history of a type of suffruticose, arid-tropical dalea of which the flowering season begins with the onset of the dry weather in fall and continues, northward interrupted by a period of dormancy near mid-winter, into middle or even late spring.

The races of *D. versicolor* can be sorted into two groups by means of a character in the leaf-rachis first noted in *D. leucantha* (our var. *argyrostachya*) by Gentry. In this variety, as also in what have been called *D. wislizeni* (= var. *glabrescens*) and *D. lasiostachya* (= var. *involuta*), the green margin is continuously grooved along the ventral side, the groove passing uninterrupted between each pair of petiolules, which perforce are a little separated at base. In typical *D. versicolor* and in those forms defined by Gentry as *D. wislizeni* subsp. *sessilis* and subsp. *calcarata* (= homonymous vars. of this account) the margins arise so close together on the leaf-stalk's adaxial side as to become wholly or partly confluent, if wholly so forming a ridge, interrupted by a transverse notch at each

pair of petiolules, if partly so then narrowly grooved in the lower part of each segment but confluent directly under the petiolules, which arise subcontiguously from the rachis proper. In the continuously grooved type the margins terminate at each pair of petiolules with a pair of so-called intrapetiolular glands, in the partly or wholly confluent types with a single gland; but in some plants, or in leaves of them, these glands, so handy as markers for the type of rachis-margin, are unfortunately lacking.

The races of *D. versicolor* as sorted by type of rachis fall into two coherent groups, here evaluated as subspecies, each composed of either three of four geographic varieties. The collective ranges of each subspecies form a surprising, interlocking, almost fully vicariant pattern, that of subsp. *versicolor* being divided neatly into two lobes by that of subsp. *argyrostachya*. In the small common range of subsp. *versicolor* var. *calcarata* and subsp. *argyrostachya* var. *argyrostachya* along the Pacific slope in the south half of Sinaloa, these sympatric (but so far as known nowhere associated) components are the most highly differentiated as to rachis-margins, and within the region assume the character of discrete species. In a perceptive discussion of leaf-ontogeny in *D. wislizeni sessilis*, Gentry (1950, p. 249) has suggested that a strongly carinate, elliptic-acute leaflet, such as prevails in subsp. *argyrostachya*, is primitive to a plane obovate membranous leaflet, such as prevails in subsp. *versicolor*. It would appear that the continuously grooved rachis, strongly correlated with the supposedly primitive leaflet, is likewise antecedent to a rachis with fused margins. If this indicates the phylogenetic history of the complex, the genesis of the species may have occurred in the central Sierra Madrean highlands and given rise to dichotomously divergent derivatives which, migrating northward and southeastward have evolved genetically separate but morphologically parallel forms.

My comprehensive concept of *D. versicolor* is explained in more detail in discussion of particular varieties below. It may be of interest to note that it is already foreshadowed by Hemsley (1880, p. 242) who listed as *D. lasiostachya* Benth. an early (Ghiesbreght) collection of typical *D. versicolor* and (with mark of interrogation) the type collection of *D. argyrostachya*. During the course of my study of *Dalea* I attempted at first to maintain a specific distinction between *D. versicolor* and its northern kindred, which I grouped at first under *D. argyrostachya*, but the vanity of this arrangement was finally brought home to me in the field. In the meantime I have, unfortunately, left in herbaria a trail of unpublished combinations, which are, however, readily comprehensible as to intent by comparison with the synonymy accepted herein.

Key to the Subspecies and Varieties of *Dalea versicolor*

1. Green margins of the leaf-rachis more ventral than lateral, the ventral face of each segment (between pairs of leaflets) not sulcate or sulcate only proximally, the margins confluent directly below each pair of petiolules and the intrapetiolular gland (if present) solitary; bicentric in range: s. Mexico from w. Jalisco to Oaxaca s. of Neovolcanic Belt, thence s.-e. to Guatemala; and Pacific slope of Sierra Madre Occidental from centr. Sinaloa and adjoining Durango to Arizona and New Mexico: subsp. *versicolor*
   2. Plants of s. Mexico (w. Jalisco through Sierra Madre del Sur to Oaxaca; Chiapas; Guatemala); *glands* on back of larger leaflets usually numerous, more than 6 each side of midrib, if large and black many more than 6.
      3. Stipules 2–5.5 mm long; Oaxaca, Chiapas, Guatemala. 132a. var. *versicolor*
      3. Stipules 0.5–1.5 mm long; w. Jalisco and s. Michoacán. 132b. var. *decipiens*

2. Plants of n.-w. Mexico (centr. Sinaloa n.-ward) and s.-w. United States; *glands* on back of larger leaflets mostly 3–6, rarely 8, large and black.
   4. Leaflets of primary cauline leaves 4–9 (10) pairs; s.-e. Arizona and adjoining New Mexico, Chihuahua, and Sonora. 132c. var. *sessilis*
   4. Leaflets of primary cauline leaves 8–12 pairs; w. slope of Sierra Madre from s. Sonora and adjoining Chihuahua to centr. Sinaloa and adjoining Durango. 132d. var. *calcarata*

1. Green margins of the leaf-rachis more lateral than ventral, the ventral face continuously grooved its whole length, the groove of each segment either open or closed, but the margins nowhere confluent and the intrapetiolular glands, if present, 2; range occupying much of the discontinuity in that of subsp. *versicolor*, over the Meseta Central s. onto both slopes of the Neovolcanic Belt from centr. Chihuahua to the Lerma-Santiago valley in Jalisco, e. to San Luis Potosí, Puebla and adjoining Veracruz, and Morelos, extending to the Pacific slope of Sierra Madre Occidental in Nayarit and Sinaloa: ssp. *argyrostachya*.
   5. Leaf-rachis narrowly grooved ventrally, the sulcus closed or almost so; Meseta Central and Neovolcanic Belt.
      6. Leaflets (nearly always pubescent) of main cauline leaves 8–12 pairs; *major stipules* 2–6 mm long; relatively northern, of the grasslands of Meseta Central from n.-e. Jalisco, Guanajuato, and San Luis Potosí to centr. Chihuahua. 132e. var. *glabrescens*
      6. Leaflets (nearly always glabrous) of main cauline leaves 4–8, exceptionally 9 (10) pairs; *major stipules* 1–2.5 mm long; relatively southern, of the Neovolcanic Belt from Lerma-Santiago valley in Jalisco e. to Veracruz. 132f. var. *involuta*
   5. Leaf-rachis openly grooved ventrally its whole length; Pacific slope of Sierra Madre in Nayarit and centr. Sinaloa. 132g. var. *argyrostachya*

132A. DALEA VERSICOLOR Zuccarini subsp. VERSICOLOR

Margins of leaf-rachis at least partly confluent ventrally, the groove between them obsolete or, if present, extending through only part of each segment, fused distally under each pair of petiolules; *intrapetiolular gland* (if present) 1; *petiolules* contiguous at point of insertion; *leaflets* commonly submembranous and flat (sometimes carnosulous in s.-e. Mexico).

Collective range: a) n. Sierra Madre Occidental, from Sinaloa into s.-e. Arizona and adjacent New Mexico, and b) Sierra Madre del Sur from w. Jalisco to s. Michoacán, s. and centr. Oaxaca; Chiapas and highland Guatemala.

Dalea versicolor Zucc. subsp. **versicolor**. *D. versicolor* Zucc., sens. ampliato. For synonymy see var. *versicolor* infra.

132a. DALEA VERSICOLOR Zuccarini var. VERSICOLOR
(Plate CXVIII)

Variable in habit, suffruticose becoming shrubby when adult, 6–15 dm tall, the stems usually several, sometimes solitary, erect and distally paniculate or in exposed

places diffuse or trailing, nearly always castaneous and at least distally ± villosulous, but sometimes hairless to the spikes; *stipules* castaneous, narrowly lanceolate, 2–5.5 mm long, becoming dry and fragile; *foliage* usually pilosulous but green or greenish, sometimes glabrate above, less often truly glabrous; *leaflets* of primary cauline leaves 5–11 (14, rarely 16) pairs, flat or loosely involute; *spikes* 10–13 (14) mm diam, the axis in those of fall and winter inflorescences 2–5 (7) cm, in vernal (or drought inhibited) ones 1–2.5 cm long; *calyx* (4.8) 5–7.2 (7.5) mm, the tube 2.5–3.3 mm, the dorsal tooth (2.3) 2.5–4 (4.3) mm long; *epistemonous petals* dull purplish-lavender or violet, in this contrasting with the clear rose-pink or purple of other vars. of subsp. *versicolor*; 2n = 14 (Mosquin). — Collections: 44 (x).

Open slopes and glades in sunny oak-pine woodland, persisting after forest clearing and colonial on eroding banks and badlands, 1700–2230 m (5700–7425 ft), locally abundant in the mountains of centr. and s. Oaxaca; highlands of Chiapas and s. Guatemala (e. to Jalapa). — Flowering September to February. — *Representative*: MEXICO. OAXACA: *Pringle 6074* (BR, F, M, MEXU, NY, W, Z); *Camp 2350, 2523* (NY); *Ripley & Barneby 14,595* (CAS, F, GH, MEXU, MICH, NY, UC, US), *14,674* (CAS, NY, US), *14,689* (DAO, NY), *13,665* (CAS, K, MEXU, MICH, NY, US). CHIAPAS: *Ghiesbreght 582* (F, K, NY); *Matuda 25,993* (NY); *Breedlove 14,196* (US). GUATEMALA. HUEHUETENANGO: *Standley 62,628, 65,814, 82,022, 82,537* (F). EL QUICHÉ: *Heyde & Lux 3314* (M, NY); *Molina et al. 16,335* (NY). CHIMALTENANGO: *S. S. White 5403* (MICH); *Standley 61,610* (F). GUATEMALA: *Standley 59,267* (F, NY). SACATEPÉQUEZ: *Williams & Molina 11,776, 15,300* (F); *Kellerman 6455* (F, UC). JALAPA: *Steyermark 32,726* (F, US).

Dalea versicolor (changeable in color) Zucc., Abhandl. Akad. Wiss. München **1**: 342. 1832, reprinted also in Flora **15**[2]: Beibl. 69. 1832. — "Crescit in imperio mexicano, unde semina misit clar. de Karwinski." — Lectotypus, labelled "*Dalea versicolor* Zucc. Hort. Monac. 1834", M (herb. Zuccarini.)! = *N. Y. Neg. 6353*; isotypi, Hort. Monac. 1835, M (herb. Kummer.)! "*Dalea* a cl. Zuccarini nuper descr...semina quae in horto Monac. plant. ediderunt legit Tlapajahua Mexican. et commun. F. W. Keerl, 1829", BR (herb. Mart.)! = *N. Y. Neg. 6351*. — *Parosela versicolor* (Zucc.) Rydb., N. Amer. Fl. **24**: 102. 1920.

Parosela tsugoides (resembling hemlock, of the narrow crowded leaflets) Rydb., N. Amer. Fl. **24**: 102. 1920. — "Type collected in the valley of Oaxaca, October 3, 1894, *E. W. Nelson 1540*..." — Holotypus, US! isotypus, NY! — *Dalea versicolor* var. *tsugoides* (Rydb.) Macbr., Contrib. Gray Herb., New Ser. **65**: 18. 1922.

The var. *versicolor* is in practice readily recognized, being the only form of its species present in southeastern Mexico and Guatemala, the one suffruticose or shrubby dalea of its region with deciduous bracts, long-toothed plumose calyces, purple petals, and six or more (usually eight or more) pairs of small leaflets in the larger primary leaves. In technical characters it closely resembles the distantly allopatric var. *sessilis*, to which it is connected by the still poorly understood var. *decipiens*, but differs from both in the relatively long castaneous stipules and dull reddish-purple coloring of the petals and from var. *sessilis* (but not var. *decipiens*) by the numerous glands scattered over the back of the leaflets. The range of var. *versicolor* is sundered by the lowlands of Isthmus of Tehuantepec, and some degree of morphological divergence is reflected by this division. East of the isthmus the foliage is consistently pubescent, and the glands on back of leaflets are relatively large and black. In Oaxaca the foliage is perhaps more often pubescent than not but in the mountainous center of the state glabrous and pubescent forms are found growing together, and the glands in either case are smaller and mostly red or orange in color. The plants of Mixteca Alta are not only remarkably unstable in details of pubescence, but also

in habit. In oak-pine forest I have seen prostrate forms growing with others virgately erect; and on eroded ridges a densely pubescent, fruticose but depressed or trailing ecotype which produces as early as December many subsessile short spikes on spurs lateral to the main axes. In Chiapas and Guatemala var. *versicolor* is sympatric with the yellow-flowered but habitally similar *D. lutea* var. *gigantea* and may hybridize with it occasionally. Specimens collected near Chiantla, dept. Huehuetenango (*Skutch 1138*, F, NY) are notable for the firm, glabrate calyx-tube, a character that might have been derived from var. *gigantea*.

Rydberg, I believe, correctly identified *D. versicolor*, but study of authentic material (cited above) raises some points which deserve discussion. According to Zuccarini the plants were grown from seed collected by Karwinski. The movements of this collector in Mexico are little known, but he was certainly in central Oaxaca at one point, and therefore had opportunities to collect the plant traditionally known as *D. versicolor*, which is common on the divide between the valleys of Oaxaca and Rio Tomellín, on the old highway south from Puebla and Tehuacán. A specimen in the Martius herbarium, certainly from the same source as that preserved at Munich by Zuccarini himself, identifies the collector of the seed as Keerl and the locality as Tlalpujahua, a mining community close to Real del Oro on the boundary between states of México and Michoacán northwest of Mexico City. The only dalea of this type known to occur near Tlalpujahua is *D. versicolor* var. *involuta*, and I feel sure therefore that Martius must have been mistaken. As will be seen from the accompanying plate, part of which was drawn from *D. versicolor* of Zuccarini's herbarium, the plant very closely resembles the Oaxacan phase with leaflets thinly pubescent below but glabrous above. It differs in one point, probably of no importance: the larger leaves have as many as 16 (according to the protologue up to 18) pairs of leaflets, whereas a range of 6 to 12, rarely 14 pairs is normal in the populations sampled subsequently. A truly exact match for Karwinski's plant may yet turn up somewhere in southern Mexico, but is unlikely to modify the comprehensive concept of *D. versicolor* formulated herein.

See also comment on *D. selerana* Harms in Appendix I.

132b. DALEA VERSICOLOR Zuccarini var. DECIPIENS Barneby
(Plate CXIX)

Suffruticose becoming shrubby, freely branched distally, (5) 7–20 dm tall, the stems glabrous below, puberulent distally; *stipules* 0.5–1.5 mm long; *foliage* puberulent, green turning brown when dry; *leaflets* of primary leaves 6–12 pairs, obovate to obovate-oblanceolate, obtuse or emarginate, 1.5–5.5 mm long; *spikes* (10) 12–15 cm diam, the axis 5–23 mm long; *calyx* 5–6 mm, the tube 2.4–2.7 mm, the dorsal tooth 2.6–3.3 mm long; *epistemonous petals* rose-pink, the keel-blades pale at outer edge. — Collections: 4 (o).

In oak or oak-pine woodland, 1000–2500 m, apparently local, known only from Sierra Madre del Sur in extreme w. Jalisco and s.-w. Michoacán. — Flowering November to April. — *Material*: JALISCO. Talpa de Allende: near Talpa, mar 1897, *E. W. Nelson 4041* (NY, US). ——: Real Alto, La Bufa, feb 1927, *Mexia 1613* (CAS, F, GH, MICH, NY, UC, US). MICHOACÁN. Coalcomán: typus. Aguililla: n.-w. of Aguililla, *McVaugh 22,685* (MICH).

Dalea versicolor Zucc. subsp. **versicolor** var. **decipiens** (deceptive) Barneby, var. nov., inter var. *versicolorem* ac var. *sessilem* ambas procul allopatricas quasi ambigens, ab illa stipulis abbreviatis petalisque roseis, ab hac statura elata foliolisque dorso glandulis numerosis parvulis conspersis abstans. — MICHOACÁN. Coalcomán: woods, local, 1000 m, Coalcomán, feb 3, 1939, *George B. Hinton 12,929*. — Holotypus, NY; isotypus, US.

A troublesome but highly interesting entity which serves as a geographical and morphological link between the otherwise widely separated northern and southeastern representatives of subsp. *versicolor* sens. lat. In general aspect var. *decipiens* suggests the form of var. *versicolor* found in Chiapas and Guatemala but differs in the short stipules and pink rather than reddish-purple or dull purple flowers. The characters by which it differs from var. *versicolor* are common to var. *calcarata* and var. *sessilis*, the collective range of which does not extend south of Sinaloa. Both of the latter may be distinguished from var. *deccipiens* by the plane green leaflets dotted beneath with few and large black glands, the var. *calcarata* further by its long calyx-teeth (3.3–5 not 2.6–3.3 mm), but in the context of the species this difference is likely to prove illusory as more material is studied. It will be of great interest to learn, as exploration of Sierra Madre del Sur continues, whether var. *decipiens* has a more continuous range through Guerrero into Pacific Oaxaca.

132c. Dalea versicolor Zuccarini var. calcarata (Gentry) Barneby
(Plate CXIX)

Suffruticose becoming shrubby, the stems 1 or few together, irregularly branched in age, (4) 5–15 dm tall, at first openly paniculate distally and bearing a few pedunculate spikes, later flowering from axillary short-shoots; *stipules* 0.7–3 mm long; *foliage* glabrous or pilosulous, when the latter greenish, the leaflets pubescent both sides or only beneath; *leaflets* of primary leaves 8–17 ("19") pairs, usually not strongly carinate beneath; *spikes* 1.3–1.6 cm diam, the axis 0.5–5 (6) cm long; *calyx* (sessile or minutely pedicellate) 6.5–8 mm, the tube 2.5–3.4 mm, the dorsal tooth 3.3–5 mm long; *epistemonous petals* lilac-pink to rose-purple. — Collections: 12 (o).

Open grassy slopes in the oak or oak-pine belt, 1300–2220 m (± 4330–7400 ft), w. slope of Sierra Madre Occidental from s. Sonora (Sierra de Alamos) and the canyons tributary to Río Fuerte in s.-w. Chihuahua s. through Sinaloa and adjoining Durango just to the Tropic line. — Flowering November to April. — *Material*: Sonora. Alamos: *Palmer 282* (NY). Chihuahua. Urique: *Caddell 23* (OKLA). Sinaloa. Badiraguato: *Gentry 5811* (ARIZ, MICH, NY), *7180* (NY), *7291* (F, NY, UC). San Ignacio: *Ortega 34* (MEXU). Durango. Santiago Papasquiaro: *Palmer 138* (C, F, NY, UC). El Salto: *Gilly 11,550* (MICH, RENNER); *McVaugh 23,604* (MICH); *Breedlove 18,910* (NY).

Dalea versicolor Zucc. subsp. **versicolor** var. **calcarata** (Gentry) Barneby, stat. nov., based on *D. wislizeni* subsp. *calcarata* (spurred, of the calyx-teeth) Gentry, Madroño **10**: 243, pl. 21, 22, fig. 3 (map). 1950. — "Los Pucheros, Sierra Surotato, northern Sinaloa, Mexico...March 24, 1945, *Gentry 7182*..." — Holotypus, not examined, DS; isotypi, F, MICH, NY, UC, US!

Dalea surotatensis (of Sierra Surutato) Gentry, Madroño **10**: 234, pl. 17. 1950. — "Above La Jolla, Sierra Surotato, Sinaloa, Mexico...March 17–24, 1945, *Gentry 7291a*..." — Holotypus, not examined, DS; isotypi, F, MICH, NY, US!

The var. *calcarata* is weakly distinguished from the vicariant var. *sessilis* by the more numerous leaflets of primary leaves. Even when it was described, Gentry admitted that there were ambiguous intermediate forms in southern Sonora. The concept of var. *calcarata*, based in the first instance on a drought-inhibited plant glabrous to the spikes, is here expanded to accomodate *D. surotatensis*, described from densely pilosulous plants collected at the stage, paradoxically in March, of maximum growth activity usually associated with autumnal flowering. This expansion might be thought, a priori, excessively liber-

al until it is reexamined in context of *D. versicolor* sens. lat., and in light of information provided by other populations of the species present in central and southern Sinaloa and adjoining Durango. A plant collected long ago by Edward Palmer at San Ramón, on headwaters of Río de los Remedios (*No. 138*, cited supra), which had been referred by Rydberg (in herb.) to *D. saffordii* and mentioned by Gentry (1950, p. 242) as anomalous subsp. *wislizeni,* is believed to represent var. *calcarata* with glabrous leaflets but still pubescent leaf-stalks. A little further south in Durango McVaugh and Breedlove recently collected another form of the same with thinly pubescent foliage. Pubescence cannot be considered taxonomically reliable in this group. Gentry considered *D. surotatensis* akin to *D. pulchra* rather than to any form of what is here called *D. versicolor*, his opinion apparently relying heavily on glandless wing-petals as a differential character. These glands (present on keel and banner in *D. surotatensis*) are lacking in numerous examples of *D. versicolor* sens. lat., among others in *Palmer 138* (NY) just mentioned.

It is certainly remarkable that the detached Sierra Surutato should harbor both glabrous and villosulous populations of one entity, but the same thing occurs in central Oaxaca in the case of var. *versicolor*. The type-series of *D. surotatensis* shows mainly terminal long-pedunculate flower-spikes such as are expected only in the fall, but Gentry collected (*no. 7180*) in the same week and same vicinity the drought-inhibited phase in which the virgate primary stem has lost large leaves and is clothed in short-shoots bearing short but not especially dense spikes. It remains to be noted that *D. surotatensis* does differ in one other point from other phenotypes of var. *calcarata*: the leaflets are charged dorsally with smaller and more numerous glands of a type that is common in var. *versicolor* and occurs, very occasionally, in var. *sessilis* also. But there seems to be no perfectly reliable differential character in any form of *D. versicolor*.

132d. Dalea versicolor Zuccarini var. sessilis (Gray) Barneby
(Plate CXIX)

Stems 1–several, mostly 2–7 dm long, suffruticulose or sometimes truly shrubby, in fall few-branched distally, each branch terminating in a relatively long spike, in spring floriferous serially along the old stems from axillary short-shoots; *stipules* 1–3 mm long; *foliage* always more or less pilosulous or puberulent, the primary leaves often less densely so than the secondary ones; *leaflets* of primary leaves 4–9 pairs, oblanceolate to elliptic or obovate, mostly obtuse or retuse, usually not strongly carinate; *spikes* 12–15 mm diam, the axis ± 0.5–2 cm long; *calyx* 5.7–7 mm, the tube 2.4–2.8 (3) mm, the dorsal tooth 3–4 mm long; *epistemonous petals* rose-pink or -purple, the keel-blades often paler in outer half; n = 7_{II} (Spellenberg, 1973). — Collections 32 (i).

Rocky hillsides and boulder-strewn canyon benches, in grama grassland and open oak woodland, 900–2100 m (3000–7000 ft), locally abundant around the periphery of the Gila basin in s.-e. Arizona (s. Pinal, Graham, s. Greenlee, Pima, Cochise, and Santa Cruz counties), s. along the w. slope of Sierra Madre to the upper Río Papagochic in Chihuahua, and through the hill-country of n.-e. Sonora as far as Sierra de Charuco on the Chihuahua-Sonora border in lat. 30° N. — Flowering late August to November, and again abundantly in April and May. — *Representative*: UNITED STATES. Arizona: *Gentry 5972* (UC); *A. & R. Nelson 1542* (NY); *Maguire 10,964* (NY, UC), *11,502* (NY); *Blumer 1477* (UC, L, W). MEXICO. Sonora: *Wiggins 11,677* (MEXU, MICH, SD, TEX, US); *Gentry 8015* (MEXU, UC), *8056* (MEXU, UC). Chihuahua: *Hartman 634* (NY); *Tucker 2519* (UC); *Correll & Johnston 21,617* (RENNER).

Dalea versicolor Zucc. subsp. **versicolor** var. **sessilis** (Gray) Barneby, Phytologia **26**: 1. 1973, based on *D. wislizeni* var. *sessilis* (stemless, of the lateral drought-inhibited vernal inflorescence) Gray, Proc. Amer. Acad. **16**: 105. 1880. — "New Mexico and Arizona, Greene, 1887, Lemmon 1880." — Lectotypus, *Greene 1070*, collected in foothills of Chiricahua Mts., 2 Apr 1877, GH! — *Parosela wislizeni* var. *sessilis* (Gray) Vail, Bull. Torrey Club **24**: 15. 1897. *P. sessilis* (Gray) Rydb., N. Amer. Fl. **24**: 104. 1920. *Dalea sessilis* (Gray) Tidest. in Tidest. & Kitt., Fl. Ariz. New Mex. 183. 1941. *D. wislizeni* subsp. *sessilis* (Gray) Gentry, Madroño **10**: 246, pl. 23, fig. 3. 1950.

Parosela sanctae-crucis (of Santa Cruz, Sonora) Rydb., N. Amer. Fl. **24**: 103. 1920 ("*Sanctae-Crucis*"), based on *Dalea wislizeni* var. *foliolis minus sericeis etc.* Gray, Pl. Wright. **2**: 38. 1853. — "Mountain ravines near Santa Cruz, Sonora, Sept. ([*C. Wright*] 986)." — Holotypus, GH! isotypi, NY, UC. — *Parosela wislizeni* var. *sanctae-crucis* (Rydb.) Macbr., Contrib. Gray Herb., New Ser. **65**: 19. 1922. *Dalea wislizeni* var. *sanctae-crucis* (Rydb.) Kearn. & Peeb. Jour. Wash. Acad. Sci. **29**: 484. 1939.

The concept of a seasonally dimorphic var. *sessilis* worked out (as *D. wislizeni* subsp.) by Gentry (1950, p. 246, pl. 23) is adopted here without reservation. Its autumnal form (*P. sanctae-crucis*), with leafy virgate stems branched distally into a panicle of spikes, resembles in habit the equivalent seasonal aspect of var. *glabrescens* (subsp. *wislizeni* Gentry, 1950, p. 240, pl. 20) but may be distinguished, as pointed out by Gentry, by less prominently keeled, flatter, more obtuse leaflets, and even more reliably by the confluence of the green margins of the rachis under each pair of petiolules. The showy spring form of var. *sessilis*, in which the stems are clad in place of primary leaves, now fallen, with a succession of subsessile heads representing axillary short-shoots, resembles the seasonal equivalent of var. *calcarata* very closely. They have essentially the same type of leaflet and can hardly be told apart except in the autumnal stage, of which the primary cauline leaves have significantly more numerous leaflets.

In the protologue Gray mistakenly attributed var. *sessilis* to New Mexico as well as Arizona, from which state all his material originated. I have seen no evidence that it occurs in New Mexico, but it is nevertheless to be expected in the mountains of the southwest corner. Gentry (1950, fig. 3) has no New Mexican station on his distribution map.

132B. Dalea versicolor Zuccarini subsp. argyrostachya (Hooker & Arnott) Barneby

Leaf-rachis continuously grooved from base to apex; *intrapetiolular glands* (if present) 2; *petiolules* usually narrowly separated at point of insertion; *leaflets* subcarnosulous, cymbiform or folded.

Collective range: centr. and s.-centr. Mexico, from centr. Chihuahua to centr. Jalisco, e. along the Neovolcanic Belt to Veracruz and on the Plateau to San Luis Potosí, reaching the Pacific slope only in Nayarit and s.-centr. Sinaloa.

Dalea versicolor Zucc. subsp. **argyrostachya** (H. & A.) Barneby, stat. nov., based on *A. argyrostachya* H. & A., Bot. Beechey Voy. 285. 1836. Vide infra sub. var. *argyrostachya* (H. & A.) Barneby.

132e. Dalea versicolor Zuccarini var. glabrescens (Rydberg) Barneby (Plate CXXI)

Stems solitary or few together, usually virgately ascending, 3–15 dm tall, commonly glabrate in lower ⅓ and pilosulous distally, rarely glabrous almost to the spikes, in

fall paniculately few-branched distally but developing in spring at least a few short-shoots terminating in abbreviated spikes; *stipules* 2–6 mm long; *foliage* most commonly silky-pilose or -pilosulous, gray or greenish, the leaflets sometimes glabrate above, the primary leaves sometimes glabrous; *leaflets* of primary cauline leaves 8–12 pairs, usually crowded, strongly carinate dorsally; *spikes* (12) 13–15 mm diam, the axis mostly 1–4 (5) or in spring 0.5–1 cm long; *calyx* (5.4) 6.4–8.2 mm, the tube 2.6–3.2 mm, the dorsal tooth (2.9) 3.4–5 mm long; *epistemonous petals* rose-purple, lilac-pink, or faintly pink-tinged; 2n = 28 (Mosquin). — Collections: 33 (ix).

Thin stony soil of grama grassland, especially along draws and rocky ravines along the e.-foothills of Sierra Madre and plateau to the e., ascending w.-ward into sunny oak-woods, 1755–2325 m (5850–7750 ft), common and sometimes forming extensive colonies, apparently calcifuge, centr. Chihuahua to n.-e. Jalisco, n.-centr. Guanajuato, and s.-w. San Luis Potosí. — Flowering September to December, late March to May. — *Representative*: CHIHUAHUA: *Pringle 242* (F, MEXU, NY), *723* (BR, F, MEXU, NY, SD, UC, W); *Correll & Gentry 22, 776* (RENNER). DURANGO: *Palmer 32* (F, NY, UC), *811* (F, NY, UC); *Ripley & Barneby 13,480* (CAS, MEXU, NY). ZACATECAS: *Ripley & Barneby 14,157* (NY); *Mahler 5741* (NY). AGUAS CALIENTES: *McVaugh & Koelz 55* (MICH). JALISCO: *Ripley & Barneby 14,136* (CAS, NY, UC), *14,517* (NY). GUANAJUATO: *Ripley & Barneby 13,348* (CAS, NY, US), *13,377* (MEXU, NY, US). SAN LUIS POTOSÍ: *Parry & Palmer 149, 155* (NY); *Rzedowski 8398, 8548* (ENCB).

Dalea versicolor Zucc. subsp. **argyrostachya** (H. & A.) var. **glabrescens** (Rydb.) Barneby comb. nov., based on *Parosela glabrescens* (balding) Rydb., N. Amer. Fl. **24**: 106. 1920. — "Type collected in the region of San Luis Potosi, 1878, *Parry & Palmer 150...*" — Holotypus, US! isotypi, GH, NY! — *Parosela lasiostachya* var. *glabrescens* (Rydb.) Macbr., Contrib. Gray Herb., New Ser. **65**: 19. 1922. *Dalea glabrescens* (Rydb.) Bullock, Kew Bull. **1939**: 196. 1939.

Dalea wislizeni (Friedrich Adolph Wislizenus, 1803–1889) Gray, Mem. Amer. Acad. II, **4** (Pl. Fendl. **1**): 32. 1849. — "Llanos, in the Sierra Madre, w. of Chihuahua, Dr. Wislizenus." — Holotypus, labelled 'Mts. w. of Chiricahui', GH! *Parosela wislizeni* (Gray) Vail, Trans. N. Y. Acad. Sci. **14**: 34. 1894. *Dalea wislizeni* subsp. *wislizeni* Gentry, Madroño **10**: 240, pl. 20, fig. 3 (map). 1950.

A graceful and characteristic plant of the grama grasslands of Mexico's central plateau, coming into flower in fall when the grasses themselves are yellow and continuing into spring. The well-known autumnal phase takes the form of tall virgate stems at first densely clad in primary and fasciculate secondary foliage, forking beyond the middle into a few-branched panicle of silky spikes. The spring-flowering phase, less often collected, preserves the original architecture of the autumnal stage, but the stems are now almost bare of leaves and carry, below the remains of autumnal spikes terminal to the branches, a variable number of short or capitate inflorescences terminal to greatly condensed axillary short-shoots. The petals are usually pale, softly pinkish or lilac, rarely of more vivid hue.

The var. *glabrescens* as defined here is equivalent to *D. wislizeni* subsp. *wislizeni* sensu Gentry (1950, p. 240, 242), with this reservation: the glabrescent or glabrate plants from San Luis Potosí which Rydberg distinguished as *Parosela glabrescens* are reevaluated as a minor variant of the ordinarily gray-silky *D. wislizeni*, coordinate with the glabrescent phases of var. *argyrostachya* and var. *versicolor*. In Sierra de Guanajuato there occur within a few miles of each other populations with all foliage pubescent in some degree and others (cf. *Ripley & Barneby 13,358*, NY) with lower leaves glabrous. Again a few miles northeastward appears *P. glabrescens*, with primary leaves glabrous or nearly so but puberulent axillary spurs. The transition is now well documented and imposes, at the varietal level, an unwelcome but mandatory change of epithet. The introduction into var. *glabrescens* of the glabrate phase raises a difficulty in separating what has been called *D. wis-*

lizeni from the next variety, hitherto passing as *Dalea lasiostachya*. This has essentially the flower and inflorescence of var. *glabrescens*, but differs in its prevailingly shorter calyx and fewer leaflets. The two varieties are vicariant, the var. *involuta* (*D. lasiostachya*) replacing var. *glabrescens* in the more mesic environment of the Neo-volcanic Belt. In one count of each variety Mosquin found var. *involuta* diploid and var. *glabrescens* tetraploid, but more counts, especially of the critical glabrate phase of var. *glabrescens*, are obviously desirable.

132f. Dalea versicolor Zuccarini var. involuta (Rydberg) Barneby (Plate CXX)

Habit of var. *glabrescens* but on average more slender, (3) 4–10 dm tall, the stems solitary or few together, paniculately few-branched distally, glabrous or the young branchlets puberulent; *foliage* commonly glabrous, but the leaf-rachis or leaflets, or both, of some axillary spurs often puberulent; *stipules* 1–2.5 mm long; *leaflets* of primary cauline leaves 4–8, exceptionally 9 (10) pairs, mostly involute or conduplicate; *spikes* 12–13 mm diam, the axis becoming 1–5.5 cm long; *calyx* 4.5–6.5 mm the tube 2.1–2.8 mm, the dorsal tooth 2.3–3.7 mm long; *epistemonous petals* lilac- or rose-purple; $n = 7_{II}$ (Spellenberg, 1973); $2n = 14$ (Mosquin). — Collections: 29 (vii).

Grassy hillsides and brushy slopes of barrancas, often in open oakwoods or thin oak-pine forest, 1530–2520 m (5100–8400 ft), not rare but seldom abundant, occasionally colonial on road-banks, Neovolcanic Range of s. Mexico from near Guadalajara, Jalisco e. through n. Michoacán, n. and centr. México, n. Morelos, centr. Puebla just into Veracruz (near Orizaba) and s.-e. Hidalgo. — Flowering primarily September to December and again in spring, but collected in flower during almost every month of the year. — *Representative*: Jalisco: *Rose & Painter 4198, 7345* (NY, US); *Ripley & Barneby 14,059* (CAS, NY). Michoacán: *Ripley & Barneby 14,803, 14,815* (NY); *McVaugh 9938a* (MICH). México (Edo & D. F.): *Pringle 3158* (BR, F, K, M, MEXU, NY, UC, US, W, Z); *Ripley & Barneby 13,393* (CAS, MEXU, MICH, NY, US); *Rzedowski 771, 25,125* (ENCB). Morelos: *Ripley & Barneby 14,545* (CAS, MEXU, NY). Puebla: *Arsène 1220* (GH), *1697* (BR, L, NY). Hidalgo: *Ripley & Barneby 13,623a* (NY). Veracruz: *Mosquin 6737* (NY).

Dalea versicolor Zucc. subsp. **argyrostachya** (H. & A.) var. **involuta** (Rydb.) Barneby, Phytologia **26**: 1. 1973, based on *Parosela involuta* (folded inward, of the leaflets) Rydb., N. Amer. Fl. **24**: 107. 1920. — "Type collected at Rio Blanco, Jalisco, 1886, Palmer 26..." — Holotypus, NY! isotypi, GH, NY, US! — *P. lasiostachya* var. *involuta* (Rydb.) Macbr., Contrib. Gray Herb., New Ser. **65**: 19. 1922.

Dalea lasiostachya (with villous spikes) Benth., Pl. Hartw. 11. 1839. — No locality given, but the collector, George John Graham, was active near Mexico City, Tlalpuxahua in n.-w. México, and Real del Monte, Hidalgo. — Holotypus, *Graham in 1830*, K! — *Parosela lasiostachya* (Benth.) Rose, Contrib. U. S. Nat. Herb. **10**: 107. 1906.

The var. *involuta* might be visualized as a slender form of the last, normally glabrous up to the spikes, with fewer (mostly 4–8 not 8–12) pairs of leaflets in primary leaves combined with shorter stipules (1–2.5 not 2–6 mm) and (on average) shorter calyx-teeth. Individual exceptions to each contrast are on record, as for example a plant from Michoacán (*Ripley & Barnehy 14,122*) with 9–10 pairs of leaflets, but otherwise characteristic var. *involuta*. Rydberg's proposed distinction between an eastern *Parosela lasiostachya* (of Puebla and México) with slightly involute leaflets and a western *P. involuta* (of Jalisco) with strongly involute and therefore apparently very narrow ones has broken down

with the collection of geographically intermediate material, especially from Michoacán. It is still true that the populations of var. *involuta* from relatively low elevations near Guadalajara have the fewest and narrowest leaflets, but the range from there east to Morelos and Veracruz is now known to be virtually uniterrupted, as is the morphological transition in development of leaves. Near its eastern limit var. *involuta* is marginally associated with *D. minutifolia*, ordinarily very different in its copiously verruculose stems, tiny leaflets, and short-toothed calyx. An ambiguous population from Hidalgo is mentioned under *D. minutifolia* as possibly hybrid.

132g. DALEA VERSICOLOR Zuccarini var. ARGYROSTACHYA (Hooker & Arnott) Barneby

(Plate CXX)

Basally lignescent tall herbs or finally shrubby, at anthesis 5–15 dm tall, the primary inflorescence a terminal to few-branched panicle but this succeeded by lateral subcapitate or shortly ovoid spikes arising from axillary short-shoots; *stipules* 0.5–2 mm long; *foliage* thinly pilosulous with weak hairs or glabrous; *leaflets* of primary leaves (7) 8–11 pairs, strongly carinate dorsally; *spikes* racemiform, without petals (10) 11–15 mm diam, the axis of those terminal to principal branchlets (2) 3–11 cm, of those on axillary short-shoots ± 0.5–2 cm long; *calyx* (5) 5.8–7.2 mm long, the tube 2.5–2.8 mm, the teeth (2.5) 3–4.4 mm long; *epistemonous petals* pale lilac or whitish. — Collections: 9 (o).

Dry grassy hillsides, sometimes in oak woodland, ± 500–1350 m, local, known only from the piedmont and detached sierras or low hills rising from the Pacific coastal plain along the w. slope of Sierra Madre Occidental in Nayarit and Sinaloa, the known localities lying between Tepic and Sierra Tacuichamona in lat. 21° 30–24° 30 N. — Flowering October to April. — *Material*: SINALOA. Cosalá: Sierra Tacuichamona, *Gentry 5685* (ARIZ, MEXU, MICH, NY). San Ignacio: San Xavier, *Ortega 1220* (MEXU), *5090* (MEXU); Cordón de Balboa, *Montes & Salazar 787* (US). NAYARIT. Tepic: Tepic, *L. Paray 2708* (ENCB); Tepic to junction of San Blas road, *Alava & Cook 1565* (MICH, UC). _____ : Territoire Huichol, Sierra de Nayarit, "Jalisco", *Diguet s. n.* (NY).

Dalea versicolor Zucc. subsp. **argyrostachya** (H. & A.) var. **argyrostachya**. *D. argyrostachya* (with silvery spikes) H. & A., Bot. Beechey Voy. 285. 1836, sens. str. — No particular station indicated, therefore from environs of Tepic. — Holotypus, labelled "Talisco, *Beechey*", i.e. Jalisco, a few km s. of Tepic, K! — *Parosela argyrostachya* (H. & A.) Rose, Contrib. U. S. Nat. Herb. **10**: 106. 1906.

Parosela leucantha (white-flowered, rarely if ever appropriate) Rydb., N. Amer. Fl. **24**: 103. 1920. — "Type collected in Tepic, [Jan] 1892, *Edward Palmer P*, in part (herb. N. Y. Bot. Gard.)." — Holotypus, 2 branches + some fragments in packet, all of one species, the "in part" of protologue unexplained, NY! isotypus, *Palmer 1871*, GH! — *Dalea leucantha* (Rydb.) Gentry, Madroño **10**: 230. 1950.

Gentry (1950, p. 226, in key) separated *D. leucantha* from *D. wislizeni* on the basis of long spikes, more openly grooved leaf-rachis, relatively long dorsal calyx-tooth, and paler petals. The first is true of primary spikes only; those from axillary short-shoots produced in spring (cf. *Paray 2708* collected April 1) are no longer. The length of calyx-teeth is variable, and the petal-color is apparently not paler than in some var. *glabrescens* of the interior plateau. Ultimately the best differential character is found in the openly sulcate leaf-rachis which coincides with a distinctive pattern of dispersal. The one other element of

the polymorphic *D. versicolor* present on the Pacific slope of Sierra Madre, var. *calcarata*, is much more easily distinguished by its confluent rachis-margins with solitary intrapetiolular gland, flat, thin-textured (not carnosulous and cymbiform) leaflets, and bright rosy-pink or purple epistemonous petals.

The types of *D. argyrostachya* and *D. leucantha* were both collected at Tepic and are narrowly conspecific. Rydberg interpreted the former by means of a drawing (NY) prepared at Kew in 1918 which he mistakenly associated with a form of *D. lutea*, believing the petals to have been yellow, in this being misled by a remark of Hooker's. No yellow-flowered dalea is known to occur in Nayarit, and all forms of *D. lutea* differ from *D. argyrostachya* in persistent interfloral bracts.

133. Dalea formosa Torrey
(Plate CXXII)

Dwarf shrubs up to 1.5–9 dm tall, glabrous below the inflorescence or nearly so (the stipules, terminal branchlets, and peduncles sometimes puberulent), with tortuous, ± intricately forking, woody branches fissured in age and clothed in papery, exfoliating bark, the young branchlets stiff but not spinescent, at first purplish, glaucescent, the small, neat, drought-deciduous foliage pallid-glaucescent, the leaflets thick-textured, punctate beneath, the inflorescence plumose-silky; *leaf-spurs* 0.4–0.7 mm long; *stipules* triangular-subulate or lanceolate, purplish becoming brownish-livid, persistent, 0.5–0.8 (2.2) mm long; *intrapetiolular glands* 0; *post-petiolular glands* prominent, conic; *main cauline leaves* 2.5–11 (14) mm long, borne on relatively long shoots with developed internodes, deciduous and absent from most vernal-flowering specimens, with thick-margined, ventrally grooved rachis and (2) 3–6 (7) pairs of obovate-cuneate, oblanceolate, or narrowly obovate, mostly folded leaflets (0.6) 1–6 (7) mm long, these subtending smaller leaves of the same type crowded or seemingly fasciculate on axillary spurs; *spikes* numerous, terminal both to branchlets and to lateral spurs, loose but mostly subcapitate and 2–9-flowered, the pilosulous axis 2–8 mm long, rarely up to 18-flowered and axis to 3.5 cm long; *bracts* early deciduous, broadly ovate tapering into a ± recurved tip, 3–6 mm long, folded around the buds but not strongly carinate, livid-castaneous becoming papery, ciliolate, glabrous or nearly so and gland-tuberculate dorsally, glabrous within; *calyx* sessile or almost so, (7.5) 8.5–13.5 (16.2) mm long, plumosely pilose with spreading-ascending, spiral villi up to (0.8) 1–2.5 mm long, the tube (3) 3.5–5 (5.2) mm long, strongly oblique at the mouth, the ribs slender becoming prominent, livid or concolorous, the membranous intervals charged with 3–4 (5), mostly uniseriate, orange or reddish blister-glands, the narrowly lance-caudate teeth becoming aristiform and arched outward in age, all gland-spurred, the dorsal one longest, (4.5) 5–7 (8.5) mm long, ± 1½–2 times as long as the tube; *petals* opening bicolored, the banner (sometimes minutely puberulent on back of blade) ochroleucous or pale yellow early rubescent, the inner petals rose- or magenta-purple, elevated 1.5–2.8 mm above the hypanthium, usually all glandless (sometimes a few small glands on banner and a small subapical gland on keel); *banner* (6.6) 7–8.8 mm long, the ventrally grooved claw 3.8–5.2 mm long, the deltate-obcordate blade (4) 4.3–5.5 mm long, (3.4) 4–6.4 mm wide, obtuse or emarginate at apex, open or recessed into a shallow cornet at base; *wings* 8–10.4 mm long, the claw 2.8–3.8 mm, the blade 5.2–7.4 mm long, 2.4–3.7 mm wide; *keel* 8.2–11.4 mm long, the claws (3.5) 3.8–5.2 mm, the blades (6) 6.3–7.6 mm long, 3.2–4.5 mm wide; *androecium* 9–12.5 mm long, the longest filament free for 2.4–4.5 mm; *anthers* gland-tipped, (0.8) 0.85–1.2 mm long; *pod* ± 3–3.5 mm long, the style-base latero-

terminal, the anterior keel slender but prominent; 2n = 7_{II} (Raven et al., 1965); 21 (Spellenberg). — Collections: 105 (vi).

Dry rocky hillsides, gullied bluffs, and knolls on the prairie, in barren places where competition from tall shrubs is low or absent, 570–2040 m (1900–6800 ft), widespread and forming part of several widely different plant-associations, from chollamesquite desert in Arizona to pinyon forest, grama-grassland, and short-grass prairie, widespread over the Edwards Plateau in Texas, n. to extreme w. Oklahoma and Mesa de Maya in s.-centr. Colorado, w. through the valleys of the Pecos and Rio Grande into centr. and s.-e. Arizona (reaching the Verde valley and the sources of the Little Colorado in s. Apache County), extreme n.-w. Sonora, and s., becoming rarer, to n.-w. and centr. Coahuila and along the e. piedmont of Sierra Madre to Ciudad Chihuahua. — *Representative*: UNITED STATES. TEXAS: *Moore & Steyermark 3355* (NY, UC); *B. & H. Jesperson 2681* (NY, UC). OKLAHOMA: *Goodman 2407* (NY). NEW MEXICO: *Fendler 132* (GH, L, NY, OXF, UC, US, W); *Metcalfe 79* (NY, UC). ARIZONA: *A. & R. Nelson 1972* (NY, UC); *Maguire 10,881* (NY, UC). MEXICO. SONORA: *Wiggins 13,363* (DS, SD, TEX). CHIHUAHUA: *Pringle 6874* (F, GH, L, M, MEXU, UC, US, W, Z); *Ripley & Barneby 13,896* (CAS, NY). COAHUILA: *R. M. Stewart 2253* (GH, TEX); *Graber 108* (TEX).

Dalea formosa (handsome) Torr., Ann. Lyc. N. Y. **2**: 177. 1827. — "On the Platte." — Holotypus, collected by Dr. Edwin James, assistant surgeon U. S. Army, on Long's Expedition, 1820, NY! — *Parosela formosa* (Torr.) Vail, Trans. N. Y. Acad. Sci. **14**: 34. 1894.

Despite a wide range and considerable variation in several features, *D. formosa* has never acquired a taxonomic synonym; its distinct nature is evident to all. On the upper forks of the Pecos and Canadian rivers, from 1400 m upward, the prevailing form of it is a miniature, crooked shrub less than 5 dm tall, with tiny leaves, relatively small flowers, and a calyx at once short-toothed (in context of the species) and shortly plumose. In the Gila basin, where it consorts with fruticose and arborescent cactaceae, the average mature bush reaches a stature of 5–9 dm, and the flower reaches its greatest size, accompanied by extremely long, long-plumose calyx-teeth. These extremes are connected by intermediate states, large flowers and long calyx teeth occur, together and separately, on plants of lowly stature, and no racial division of the species is apparent. Rarely, especially in Arizona, long-shoots developing in rainy springs give rise to terminal spikes with as many as 10–18 flowers spaced out along an axis up to 3 cm long; however the spikes borne on lateral spurs of the same plant are short and few-flowered as normal in the species. The long spike is of interest because, detached from the plant, it resembles that of some forms of *D. versicolor* and suggests that *D. formosa* arose, by the path of specialization, reduction (of leaflet- and flower-number) and adaptation to a colder climate, from some *versicolor*-like prototype. An approach to the capitate inflorescence is found well-advanced in the drought-form of *D. versicolor* var. *sessilis*. Very occasionally the banner of *D. formosa* bears a few hairs on the back of the blade just above junction with the claw, a feature of several South American daleas that is of extreme rarity elsewhere. At its altitudinal limit in southern Colorado and adjoining New Mexico *D. formosa* must endure zero temperatures and deeply frozen ground, conditions that no related species tolerates.

Several daleas of the same type as *D. formosa* enter the southern part of its range, but may be distinguished as follows: *D. bicolor* var. *argyraea* (in western Texas and adjoining states) and *D. pulchra* (in southeastern Arizona and adjoining Sonora) by their densely silky-pubescent foliage and short calyx-teeth; *D. greggii* (in western Texas southward) by the same characters combined with procumbent-radicant branches; *D. tentaculoides* (local in southern Arizona) by the peculiar medusoid glands on the calyx; and *D. versicolor* by more numerous leaflets (over four pairs in main leaves) which always bear some

silky hairs at least on the lower face. No sympatric shrubby dalea has calyx-teeth over 4 mm long.

The type-locality was said by Torrey to be on the Platte (i.e. the South Platte) River. No modern collection of *D. formosa* has been seen from north of Mesa de Maya in western Las Animas County, Colorado. James (Exped. Rocky Mts. **2**: 73. 1823) records the discovery on July 26, 1820 near his camp on the upper Purgatoire River of a "beautiful *Dalea*," a flower so remarkable as to provoke transcendental thoughts on the subject of Beauty arising spontaneously out of the Wilderness. It is likely that this was *Dalea formosa*, here at or close to its northern limit.

IVC (xxii). Series Purpusianae Barneby

Stiffly branched small shrubs of rounded outline, thinly pilosulous but greenish, the young stems sparsely minutely tuberculate, the axis of the flower-spikes persisting as a stout woody thorn; *leaflets* 1–2 (3) pairs, obovate-cuneate or obcordate, *spikes* loose; *bracts* deciduous; *calyx* long-pilose, the intercostal panels of tube charged with 1 row of glands, the narrowly lance-caudate teeth 1.5–3 times longer than tube, plumose; *petals* bicolored, the banner opening creamy, early rubescent, the purple (when dry dark purple) epistemonous ones perched low on the androecium (up to ± 2 mm distant from hypanthium-rim), the detached keel longer than the banner, its blades ± 6–7.5 mm long. — Sp. 1, of middle Baja California.

Dalea subgen. **Parosela** sect. **Parosela** ser. **Purpusianae** Barneby, ser. nov., verosimiliter *Versicoloribus* affines, sed spicarum axis cum pedunculo brevi hornotinus jam rigidus annotinus lignescens pseudospinosus fit, fruticulus adultus ideo more *Psorothamni* specierum nonnullarum horridus evadit. Foliolia paucijuga mox decidua, calycis dentes longissime caudati, ac petala epistemonea demum atrovinacea notulas ulteriores peculiares proferrunt. — Sp. unica: **D. purpusi** Brandegee.

When first discovered, *D. purpusi* was mistaken by Brandegee (Proc. Calif. Acad. Sci. II, **2**: 147) for the distantly allopatric *D. formosa*, which it resembles in its few leaflets, long, plumose calyx-teeth, and large flowers. This pair of species remained associated in Rydberg's monograph, together forming the small group *Formosae*. The detached calyx of *D. purpusi* also resembles that of *D. filiciformis*, except that it lacks the pedicel, and equally that of some aspects of *D. versicolor*; but the plant differs greatly in habit from all those mentioned, the mature bush becoming a rounded tangle of crooked branchlets armed here and there with stout thorns that develop, like those of *Psorothamnus spinosus*, from lignified raceme-axes of preceding years. No comparable modification is known in any member of *Versicolores*, from which *D. purpusi* seems further isolated by geographic and ecological factors.

134. Dalea purpusi Brandegee
(Plate CXXII)

Intricately and rigidly branched, finally thorny shrubs of rounded outline up to 4–8 dm tall, the old wood gray and furrowed, the young branches terete but sparsely micro-tuberculate, like the foliage thinly pilosulous with subappressed, silky hairs up to 0.2–0.35 mm long, the leaflets green, pubescent both sides, smooth above, punctate beneath, the inflorescence silky-pilose; *leaf-spurs* 0.3–0.5 mm long; *stipules* triangular-subulate, livid, 0.8–1.4 mm long; *intrapetiolular glands* 0; *post-petiolular glands* small

but prominent, rounded, red or livid; *main cauline leaves* early deciduous, shortly petioled, 8–25 mm long, with narrowly thick-margined, ventrally flattened or shallowly grooved rachis and 3–5 (7) obovate or obovate-cuneate, emarginate, or obcordate, flat leaflets 3–8 (10) mm long, the upper leaves and those borne on axillary spurs 1–3-foliolate, the leaflets of the same type but smaller; *peduncles* terminal to short, stiff, leafy branchlets, these in the second year persisting as thick thorns; *spikes* loosely ± 10–20-flowered, without petals ± 2–2.4 cm diam, the hirsutulous axis becoming 1–3 cm long; *bracts* early deciduous, lance- or ovate-acuminate, openly boat-shaped, ± 4 mm long, gland-verrucose and pilosulous dorsally, glabrous within, ciliolate, livid toward the tip; *calyx* sessile, 8–12.4 mm long, plumosely pilose with fine, straight, divaricate and ascending, spiral hairs up to 1.2–1.8 mm long, the tube 2.8–3.5 mm long, oblique at mouth, the slender ribs becoming prominent, castaneous or livid, the membranous intervals charged with ± 3–5, mostly 1-seriate, orange or golden blister-glands, the narrowly lance-caudate, gland-spurred, green or livid teeth of subequal length, flexuously arched outward distally, the dorsal one 5.2–9.5 mm long (1½–3 times as long as the tube); *petals* opening bicolored, the banner cream-colored, early rubescent, the inner petals lavender-purple becoming dark plum-purple when dry, elevated 0.8–2.1 mm above the hypanthium, all glandless; *banner* ± 8 mm long, the claw 3.5–3.8 mm, the deltate-ovate, slightly hooded blade 4.4–5 mm long, almost as wide, open at base but callous-thickened either side of claw, recurved through 40°; *wings* ± 8 mm long, the claw 3 mm, the blade 5.7–6 mm long, 2.6–2.9 mm wide; *keel* 10.4–11 mm long, the claws 4–4.2 mm, the blades 6.6–7.4 mm long, 4–4.2 mm wide; *androecium* 9.2–11.5 mm long, the longest filament free for 3–4 mm; *anthers* gland-tipped, 0.9–1 mm long; *ovary* pilose, the pod unknown. — Collections: 8 (o).

Arid brushy hillsides and bouldery washes, 420–825 m (1400–2750 ft), rare and local, known only from the east side of the Baja California peninsula in long. 111° 31′ –113° 30′ W, lat. 26–28° N, from near Calmallí, extreme southern Distrito Norte, to Sierra Giganta w. of Loreto, Distrito Sur. — Flowering irregularly, December to April, possibly later. — *Material*: BAJA CALIFORNIA (Edo); Calmalli (paratypus). BAJA CALIFORNIA (distr. Sur): s. base of Tres Vírgenes Peak, *Shreve 7050* (ARIZ, F, US); 24–25 mi e. of San Ignacio, *Gentry & Fox 11,753* (MEXU, RENNER); *Wiggins 7933* (DS, F, UC, US); n.-w. slopes of Sierra Giganta, *Carter 5190* (NY, sterile in Oct.); n. of Rancho Viejo on Loreto-San Javier road, *Carter 5047* (NY, sterile in Sept.); Cuesta de las Parras between Loreto and San Javier, *Carter & Sharsmith 4211* (UC).

Dalea purpusi Brandegee, Erythea **7**: 2. 1899 ("*Purpusi*"). — "Plants with fruit and old flowers were collected by the writer in 1889, at San Esteban, Baja California, and by Dr. C. A. Purpus, in March, 1898, near Calmalli, not quite in bloom." — Lectotypus, *Brandegee in 1889*, from San Esteban, UC! paratypi (*Purpus 223*), F, UC, US! — *Parosela purpusi* (Bdg.) Rose in Contrib. U. S. Nat. Herb. **10**: 106. 1906.

The only shrubby dalea known to occur in the range of *D. purpusi* is *D. bicolor* var. *orcuttiana*, easily distinguished by the presence of 9–15 leaflets in the main cauline leaves, the denser spikes of usually smaller flowers, and a relatively short-toothed calyx (the dorsal tooth less than 4 mm long, shorter than or only a trifle longer than tube). The two other species of sect. *Parosela* found in Baja *California*, both to the south of *D. purpusi*, have almost the calyx of *D. bicolor* and in addition warty stems and glabrous foliage. The fresh petals of *D. purpusi* are described by Dr. Annetta Carter as lavender-purple, but the pigment seems to be different from that in flowers of most *Versicolores*, becoming deep plum-purple when dried, not pink or discolored pink. Carter reports that in the region of

Sierra de la Giganta the plants are seldom encountered in flower, the inflorescence apparently developing only several weeks after the sporadic rains, not until most primary cauline leaves have been shed, and the plant itself is preparing to revert to aestival dormancy. Wiggins (1964, p. 675) describes the leaflets of *D. purpusi* as 3–13 in number, but I have observed no more than seven in any leaf. At full anthesis, with its proportionately enormous, richly colored flowers set off by the silky-plumose calyces, *D. purpusi* ranks high for beauty among many decorative desert daleas. The figure given by Wiggins (in Shreve & Wiggins, 1940, pl. XII) is excellent.

IVC (xxiii). Series SEEMANNIANAE Barneby

Probably fruticose, the young stems smooth; *leaves* and *leaflets* ample, the latter up to 9 pairs, submembranous, obovate-elliptic, subacute, flat 1–1.4 cm long; *spikes* loosely subracemose, the pedicels obscure; *calyx* long-pilose, the tube deeply recessed behind banner, its narrow intercostal panels charged with a few minute, 1-seriate glands, the lance-acuminate teeth 2–3 times as long, plumose; *petals* of unknown color when fresh, the epistemonous ones perched low on the androecium, the detached keel much longer than banner, its blades nearly 7 mm long; *ovary* charged with 2–3 linear-oblong, vertical blister-glands. — Sp. 1, of Sierra Madre Occidental at elevations unknown, either in Sinaloa or Durango.

Dalea subgen. **Parosela** sect. **Parosela** ser. **Seemannianae** Barneby, ser. nov. affinitatis ignotae, calycis breviter pedicellati dentibus longissimis plumosis *Versicolores* nonnullas simulantes sed foliolis magnis expansis ideoque habitu incongruae; foliolorum forma *Thyrsifloras* refert sed petala eglandulosa calyxque pedicellatus inter eas anomala. — Sp. unica. **Dalea sericocalyx** (Rydb.) Riley.

135. DALEA SERICOCALYX (Rydberg) Riley
(Plate CXXIII)

Probably shrubby but of unknown stature, except for glabrate older branches thinly pilosulous throughout with fine ascending and spreading hairs up to 0.6–0.7 mm long, the ample thin-textured foliage green, the leaflets pubescent both sides, charged beneath with many scattered blister-glands; *leaf-spurs* less than 1 mm long; *stipules* linear, livid becoming dry and fragile, up to 2.5 mm long; *intrapetiolular glands* 0; *post-petiolular glands* small but prominent; *leaves* subsessile, the main cauline ones 5–7 cm long, with slender, ventrally flattened but scarcely margined rachis and up to 9 pairs of obovate or obovate-elliptic, short-acuminate, flat leaflets 1–1.4 cm long, the terminal one distant from the last pair, the leaves of axillary spurs smaller, with only 3–5 pairs of shorter leaflets; *peduncles* terminal to all ultimate branchlets, 1-2.5 cm long; *spikes* subracemose, loosely 10–20-flowered, the flowers ascending, the axis 2–4 cm long; *bracts* deciduous, narrowly lance-acuminate or -caudate, 7–9.5 mm long, at the incurved, submembranous-margined, keeled and loosely folded base ± 1 mm wide, distally firm and brownish, dorsally pilose and subglandular; *pedicels* up to 0.2 mm long, subtended by 2 gland-spicules; *calyx* ± 11 mm long, hirsute with fine straight ascending hairs up to 2 mm long, the tube (measured to dorsal sinus) 3 mm long, strongly recessed behind banner, the ribs slender but prominent, the membranous intervals charged with 0–3 minute glands, the slenderly lance-acuminate or -aristate teeth subequal, ± 8 mm long, straight, gland-spurred, plumose; *petals* (known

only from antique specimens) apparently brownish-purple, glandless, the epistemonous ones perched less than 1.5 mm above hypanthium; *banner* ± 5.7 mm long, the claw 3 mm, the deltate-cordate subacute blade recurved through ± 40°, at base recessed down the claw into a cornet opening adaxially, 3.4 mm long, 3.8 mm wide; *wings* 7.3 mm long, the claw 2.4 mm, the blade lance-oblong, 5 mm long, 2.2 mm wide; *keel* 9.4 mm long, the claw 2.9 mm, the blades broadly elliptic, 6.9 mm long, 3.5 mm wide; *androecium* 10-merous, 7–7.5 mm long, the longer filaments free for nearly 3 mm, the connective gland-tipped, the oblong anthers 1–1.2 mm long; *ovary* and young pod glabrous proximally, the valves charged with 2-3 large linear-oblong, vertical and subparallel blister-glands, the ripe pod unknown. — Collection: 1 (typus).

Habitat unknown, but to be sought in the pine-oak belt on the Pacific slope of Sierra Madre in s. Sinaloa or adjacent Durango, very likely flowering in winter.

Dalea sericocalyx (Rydb.) Riley, Kew Bull. **1923**: 338. 1923, based on *Parosela sericocalyx* (with silky calyx) Rydb., N. Amer. Fl. **24**: 63. 1919. — "Type collected in Sierra Madre (Sinaloa or Durango) by *Berthold Seemann*..." — Holotypus, GH! isotypi, BM (numbered *2182*), K!

This is one of several remarkable and still little known species discovered by Berthold Seemann on his journeys across Sierra Madre, coming and going between the coast and Ciudad Durango during the winter of 1848–49, while *H.M.S. Herald* was undergoing repairs in the harbor at Mazatlán. The specimens show only the top of the plant, and its stature can only be guessed at; it should nevertheless be easily recognized by its ample pilosulous leaflets and loose barbate spikes of exceptionally long-toothed calyces. The petals, described by Rydberg from material already 80 years old as "reddish-purple", are now brownish; it is impossible to say whether they were originally bright purple or greenish-yellow and rubescent. Until more is learned on these points, it seems idle to speculate, except negatively, on the relationships of *D. sericocalyx*. The general aspect of the foliage, with its expanded plane leaflets, the terminal one stalked, is rather suggestive of *D. carthagenensis* sens. lat., but the flower is less so. The type-collection was originally misidentified by Seemann (Bot. Herald 279. 1857) as *D. lachnostachya* Gray and was still associated with that species by Rydberg (1919). in *Parosela* subgen. *Trichopodium*. Conforming to the diagnosis of the *Lachnostachydes*, the flowers were described as "subsessile, reflexed after anthesis," but the specimens do not confirm this. There are vestigial pedicels, it is true, but the form of the flower is entirely foreign to *D. lachnostachya* and its near kindred, and wherever the relationship of *D. sericocalyx* may prove to be, it is certainly not to be sought in the subgen. *Theodora* of this account. In the rather unusual outline and form of the banner and in the extremely long-toothed calyx there are suggestive resemblances (cf. Pl. CXIII, CXXIII) between *D. sericocalyx* and *D.* (*Versicolores*) *lamprostachya*, another rare species described from Sierra Madre inland from Mazatlán. The leaflets of *D. lamprostachya* are much fewer, narrower, and carnosulous, the bracts persist between the flowers, and the calyx itself is sessile; the similarities may be purely coincidental, but the point will need reconsideration when fresh flowers of *D. sericocalyx* are secured. The curious elongate glands on the forming pod of *D. sericocalyx* have no known match in ser. *Versicolores*; the ripe fruit will hold much interest.

IVC (xxic). Series Leptostachyae Barneby

Slender xerophytic shrubs attaining treelet stature, with ample, glabrous or thinly villosulous foliage of thick texture; *leaflets* of primary leaves 2–5 pairs, rhombic-elliptic to oblanceolate, acute or subacuminate, 1–2.5 cm long; *spikes* long, lax, flexu-

ous, early bractless; *calyx* sessile, densely silky-pilosulous externally, the triangular-subulate to -aristate teeth unequal, the dorsal one either longer or shorter than the inconspicuously gland-charged tube; *petals* pale greenish-yellow, fading brownish-purple, the epistemonous ones perched low on androecium, the detached keel a little longer than banner, its blades ± 4–5.5 mm long. — Sp. 1, of hot brushy hillsides and barrancas below 1700 m around e. periphery of Balsas Depression in Morelos, s.-e. Puebla, Guerrero, and e. Michoacán, perhaps reaching the coast in Guerrero.

Dalea subgen. **Dalea** sect. **Parosela** ser. **Leptostachyae** Barneby, nom. nov., based on *Parosela* subgen. *Euparosela* XX. *Acutifoliae* Rydb., N. Amer. Fl. **24**: 85. 1920. — Sp. unica: *P. acutifolia* sensu Rydb., N. Amer. Fl. **24**: 86, quoad descr., syn. omn. exclus. = **Dalea leptostachya** DC.

A distinctive monotype, notable for the few, exceptionally large leaflets, pliant, ament-like spikes of relatively short-toothed calyces, and greenish-yellow petals. In habit it resembles some forms of *D.* (*Versicolores*) *melantha*, which may be its nearest relative. The serial epithet *Acutifoliae*, based on a misunderstanding, must be changed.

136. Dalea leptostachya DeCandolle
(Plate CXIII)

Slender shrubs (0.7) 1–3 m tall, with 1–3 erect, mostly simple trunks up to 1.5 cm diam near base, freely and loosely branching distally, either glabrous (except for minutely ciliolate stipules) up to the inflorescence or some upper leaves villosulous marginally on both sides with fine short ascending hairs, the older stems purplish-brown becoming corky and furrowed, the young twigs greenish or purplish, sometimes glaucescent, sparsely verruculose, the foliage somewhat bicolored, the leaflets bright green or golden-green and visibly penninerved above, paler and punctate beneath; *leaf-spurs* 0.6–1.5 mm long; *stipules* narrowly triangular-subulate, 0.5–1 (1.5) mm long, livid; *intrapetiolular glands* 0; *post-petiolular glands* large, obtuse, not strongly emergent; *leaves* petioled, (2) 3–11 cm long, with subterete but narrowly margined rachis and 2–5 pairs of relatively large and distant, elliptic, rhombic-elliptic, or broadly oblanceolate, acute to short-acuminate, gland-tipped leaflets (5) 10–27 mm long, carinate dorsally, the margins charged with a row of close-set livid impressed glands, hence sometimes minutely crenulate; *peduncles* both leaf-opposed and terminal to branchlets, 1.5–6 (8.5) cm long; *spikes* long, lax, narrow, the flowers (pressed) falling into ± 2 series revealing the pilosulous axis, this becoming (1) 2.5–12 (15) cm long; *bracts* deciduous, ovate, short-acuminate, firm, navicular and keeled dorsally, 2.5–4.5 mm long, glandular and glabrous on back, ciliolate, glabrous within; *calyx* (sessile) 4.4–6.2 mm long, densely silky-pilosulous with yellowing hairs, the rather firm-textured tube 2.3–2.8 (3.5) mm long, the ribs thick, bluntly prominent, the intervals minutely impressed-glandular, the deltate- or triangular-acuminate or subaristate teeth unequal, the dorsal one longest, recurved in age, 1.9–2.8 (3.5) mm long, either longer or shorter than tube, the rest shorter and proportionately broader; *petals* greenish-yellow early fading brown or livid-purple, the banner and keel gland-tipped, the banner often also gland-sprinkled near its eye, the epistemonous ones perched much below middle of androecium (± 1–2 mm above hypanthium); *banner* subcarnose, (4) 4.6–6 mm long,

the claw 1.7–2.3 mm long, the rhombic-ovate blade recurved through ± 20°, (2) 2.6–3.6 mm long, 2.4–3.2 mm wide, hooded and at base recessed into a shallow cornet opening adaxially; *wings* 4–6.4 mm long, the claw 1.1–1.7 mm, the ovate- or lance-oblong blade 2.8–5 mm long, 1.5–2.4 mm wide; *keel* (5.8) 6–7.7 mm long, the claws (1.6) 2–2.7 mm, the broadly ovate-obovate blades (3.8) 4–5.4 mm long, 2.2–3.1 mm wide; *androecium* 10-merous, 6.2–7.6 mm long, the longer filaments free for 2.2–2.7 mm, the connective gland-tipped, the anthers 0.75–0.9 mm long; *pod* in profile triangular, moderately compressed, 3.2–4.5 mm long, the latero-terminal style-base up to 1.3 mm long, the prow ± dilated, 0.5 mm wide, the valves hyaline in lower ½–⅔, thence greenish, softly pilosulous, and charged with a few small glands; *seed* 2.3–2.9 mm long; 2n = 14 (Mosquin). — Collections: 37 (v).

Dry rocky and brushy hillsides, commonly but not exclusively on limestone, mostly between 700 and 1650 m (2100–5500 ft), locally plentiful around the periphery of the e. lobe of Balsas Depression, from e. Michoacán (mpos Jungapeo and Huetamo) and s.-w. México (mpo Temascaltepec) through Morelos into s.-w. Puebla (mpos Izúcar de Matamoros and Patlalcingo), s. to the n. slope of Sierra Madre del Sur in Guerrero; reported from the Pacific Coast in Guerrero (near Acapulco) and on questionable evidence from n. Michoacán (Morelia). — Flowering September to February. — *Representative*: MICHOACÁN: *Hinton 6968* (ARIZ, F, NY, UC, US, Z); *Paray 1758* (ENCB). MÉXICO: *Hinton 5184* (ARIZ, F, US), *5292* (F, US, W). MORELOS: *Berlandier 1073* (OXF); *Pringle 11,287* (F, MEXU, NY, US, Z), *11,416* (ARIZ, F, OKLA, UC, US); *Ripley & Barneby 13,696* (CAS, NY, US). GUERRERO: *Pringle 8410* (F, L, M, MEXU, MICH, NY, UC, US, Z); *Rzedowski 23,525* (ENCB, MICH); *Feddema 2776* (MICH); *Paray 1859* (ENCB).

Dalea leptostachya (with lean spikes) DC., Prod. **2**: 246. 1825. — "...in America calid." — Holotypus, "ex herb. Thibaud., 1815", G-DC!

Dalea ovalifolia (with oval leaflets) G. Don, Gen. Hist. Dichl. Pl. **2**: 226. 1832. — "Native of Mexico...(v.s. in herb. Lamb.)." — Holotypus, labelled "*D. ovalifolia* sp. nov. de Mexico", OXF! isotypi, G ("*D. ovalifolia*, N[ueva] E[spaña]"); *Herb. Sessé & Mociño 2670*, MA, F (fragm)!

Parosela acutifolia sensu Rydb., N. Amer. Fl. **24**: 86. 1920; non *Dalea acutifolia* DC.

An unmistakable dalea, amply characterized by the syndrome of leaves large for the genus, composed of 5–11 acute to shortly acuminate leaflets mostly over 1 cm long, and loose, flexible spikes of dull yellow flowers. The mature plant assumes the form of a slender treelet, with one or few crooked simple trunks dividing distally into an irregularly doming head of pliant, thinly leafy branchlets. Rydberg (1920, pp. 85, 86, under the misplaced name *Parosela acutifolia*) described *D. leptostachya* as glabrous up to the silky-pilose calyces, but this is only sometimes accurate, the foliage and young twigs, especially distally, varying from truly hairless to gray-silky, sometimes (cf. *Ripley & Barneby 13,696*, cited supra) in individuals growing side by side.

With two exceptions all known specimens of *D. leptostachya* originated from within the eastern lobe of the Balsas Depression, and this is certainly its focus of abundance. It was not collected by early botanists at Acapulco, but was encountered there recently (*Paray 1859*, cited supra); its status as an aboriginal native along the south slope of the Pacific cordillera requires confirmation. The same is needed in the case of an unnumbered unicate attributed to Arsène (in 1910, F), supposedly from near Morelia de Michoacán, but under suspicion as one of the pirated exsiccata distributed under this label.

IVC (xxv). Series Thyrsiflorae (Rydberg) Barneby

Shrubs, sometimes flowering precociously as herbs, some reaching 2–2.5 m, mostly smaller, the stems and leaves glabrous to densely villosulous; *leaves* dimorphic, the primary cauline ones larger, drought-deciduous, with 3–12 pairs of leaflets, these commonly but not always submembranous, flat, less often carnosulous and shallowly navicular (rarely conduplicate), the leaves of short-shoots smaller and often simpler; *spikes* numerous and short, mostly less than 2 cm long except for a few early pedunculate ones central to each main division of the panicle, the distal ones sessile or very short-pedunculate, the spikes arranged in cymose corymbs or often, by shortening or obsolescence of ultimate and penultimate branchlets, in complex thyrsiform or spiciform panicles; *bracts* deciduous (sometimes tardily); *calyx-teeth* usually longer, rarely shorter than tube; *petals* opening creamy to greenish-ochroleucous or vivid greenish-yellow (sometimes red-margined), all gland-tipped, the low-perching episte-monous ones early turning dull brownish-purple, maroon purple, or blackish, the keel-blades 2.3–6 mm long. — Spp. 4, mostly polymorphic and variable, of extremely wide dispersal mostly at low and moderate elevations in the arid tropics, from s. Florida, s. Texas, and s. Sonora s. to s. Pacific Peru and the Bolivian Plateau; Galapagos Is.

Dalea subgen. **Parosela** sect. **Parosela** ser. **Thyrsiflorae** (Rydb.) Barneby, comb. nov., based on *Parosela* subgen. *Euparosela* XXXIX. *Thyrsiflorae* Rydb., N. Amer. Fl. **24**: 112. 1920. — Sp. typica: *P. thyrsiflora* (Gray) Vail = (syn. tax.) **Dalea scandens** var. **paucifolia** (Coult.) Barneby.

Parosela subgen. *Euparosela* XXXVII. *Microphyllae* Rydb., N. Amer. Fl. **24**: 108. 1920, pro parte, quoad sp. typ. — Sp. typica (by indirection; cf. Rydb., N. Amer. Fl. **24**: 109, nota): *P. microphylla* (H. B. K.) Rose = (syn. tax.) **Dalea carthagenensis** var. **brevis** (Macbr.) Barneby.

Rydberg's concept of a group *Thyrsiflorae* is extended here to accomodate the South American *D. microphylla* H.B.K., *D. trichocalyx* Ulbr., *D. pilocarpa* Rusby, the Galapagan endemic *D. tenuicaulis* Hook. f., and the Mexican *D. zimapanica*. The first and last of these formed the nucleus of Rydberg's kindred group *Microphyllae*, supposed to differ in having all spikes terminal to developed primary or secondary branches, none subsessile at the tip of axillary spurs. The difference in arrangement of spikes is, however, one of degree only, a more or less pronounced contraction of a many-headed, primitively corymbose panicle into a compound thyrse. As reorganized here, the *Thyrsiflorae* differ collectively from other shrubby daleas with long calyx-teeth and apically glandular, versicolorous (yellow or yellowish, early rubescent or nigrescent) petals in the repeatedly branching inflorescence and the small size of the spikes. The series is equivalent to *Thyrsiflorae* and *Microphyllae* Rydb. combined, only *D. melantha* being transferred to another series.

Variation in *Thyrsiflorae* is of two sorts, which must be carefully distinguished before a taxonomic treatment can be attempted: one morphological, affecting distribution, density, and length of vesture, leaflet-number, size of calyx and size or number of its intercostal glands, curvature of calyx-teeth, size of petals (especially of the keel-blades), and a few less important features; the other seasonal, affecting the size and number of leaflets present at a given moment in the plant's yearly cycle, the length of peduncles, and so the apparent organization of the inflorescence as a whole. All *Thyrsiflorae* are subject to both types of variation, with protean consequences, and it is often difficult, or indeed impossible, to discriminate between inherited and individual differences. Specific lines are particularly difficult to draw, and no interpretation of the complex is likely to escape criticism from one quarter or another. In practice it is convenient to segregate from the mass *D.*

zimapanica and *D. tenuicaulis*. Both are very closely related to the polymorphic *D. carthagenensis*, but may be recognized by particular combinations of characters and sharp geographic boundaries. The first has petals opening deep greenish-yellow edged with red, relatively numerous and small, thick-textured leaflets, the last three disposed in a palmate trefoil, and an openly corymbose-paniculate inflorescence. The second, confined to the Galápagos Islands and no doubt modified by the desert climate, carries the theme of dimorphic branches and seasonally dimorphic leaves to an extreme expression, with leaflets always glabrous, carnosulous, and folded. These are traditionally accepted as species. The following remarks concern the litigious residue, the genuine *Thyrsiflorae* in Rydberg's sense.

The members of this group come into flower near the autumn equinox, and may continue in active growth until spring; or in tropical desert the plants may flower at any time of year in response, always delayed, to a rainy season. Under the stimulus of moisture the individual plant develops rapidly and is relatively densely leafy; upwardly the stems branch repeatedly and give rise to some or many pedunculate, leaf-opposed spikes. As the season advances and growth slows, or even at onset of anthesis under dry conditions, the primary cauline leaves, composed of larger and more numerous leaflets than those of secondary short-shoots, are deciduous by disjointing first of the petiolules and then of the leaf-stalk. At length all of these fall away, and only shorter and simpler leaves proper to twigs of the second or third order of ramification persist. At the same time the ultimate branchlets elongate little or not at all, finally being reduced to a single depauperate headlike spike axillary to a small cauline leaf. The great difference in appearance between the young plant with early pedunculate spikes associated with large primary leaves and the mature, drought-modified plant with only sessile heads accompanied by short leaves, has led to duplication of described species, as in the case of *Parosela occidentalis* and *P. platyphylla*, which are merely seasonal aspects of the same entity.

Disregarding seasonal dimorphism and (with few minor exceptions) the distracting, superficially disparate pubescence-forms characteristic of the group, it is possible to discern fourteen taxa, each distinguished from the rest by some combination of minor morphological characters confirmed by a rational dispersal pattern. If nothing were known about the distribution, the character-combinations would appear more or less random, and no decisive dichotomy between groups of races within the complex could be made out. It would then be logical to treat the whole group as one massive polymorphic conglomerate. Clausen (1946) took a long step in this direction when he combined five of Rydberg's *Thyrsiflorae* into a widely ranging *D. carthagenensis* composed of three subspecies, these separated in terms of leaflet-number and curvature of the calyx-teeth. Clausen was concerned primarily to establish a name in *Dalea* for the so-called *Parosela floridana*, and left out of consideration several North American and all the South American elements of the complex, each of which have some bearing on the taxonomy. While wisely rejecting leaf-pubescence as a workable differential character, Clausen failed to appreciate the seasonal aspect of variation in the leaves, and he excluded *D. scandens* (of special nomenclatural interest because of its early date) because of its supposedly climbing stems and blue flowers, apparently not genuine attributes. Clausen's subspecies are a typical one, characterized by straight calyx-teeth and leaflets averaging 11 or more, ranging from Colombia and Venezuela to Puerto Rico; a subsp. *domingensis*, similar but with some curved calyx-teeth, found in Puerto Rico, Hispaniola, and southern Florida; and a subsp. *thyrsiflora*, with hooked teeth but only about seven leaflets, ranging from southern Texas to Central America and Cuba.

This treatment is in some respects immoderately simplified. For example, the common Central American element of the complex described below as *D. carthagenensis* var. *barbata* has straight teeth accompanied by relatively many leaflets and would be referred by Clausen to typical ssp. *carthagenensis*, not cited from north of Panama. On the other hand

the sympatric *D. vulneraria* (= *D. scandens* var. of this account), referred by Clausen to his subsp. *thyrsiflora* because of its hooked teeth, has the correct leaflet-number only in the mature, drought-depleted phase. An objection can be raised to describing the calyx-teeth of subsp. *domingensis* as hooked, when they vary from truly straight to slightly incurved at tip. Moreover it seems certain that there is only one dalea of the type under consideration, not two, in Puerto Rico.

It is proposed here to divide the material into two primary specific groupings, *D. carthagenensis* and *D. scandens*. This arrangement appears justified by the existence side by side in Central America of the two varieties mentioned in the preceding paragraph. These are sympatric in the narrowest sense, often found growing together, with no suggestion of ecological or altitudinal segregation, as one might expect of two races of the same species. They are similar in foliage and in flower-size, but differ abruptly in the calyx, that of *D. carthagenensis* var. *barbata* being densely pubescent from base upward, with straight teeth and several small immersed glands in each intercostal membrane, that of *D. scandens* var. *vulneraria* being glabrous or nearly so and vernicose up to the base of the plumose, strongly uncinate teeth, with only 1–3 large, often confluent intercostal blister-glands. The former passes southward into genuine *D. carthagenensis* and its relationship in this direction is beyond dispute. The latter differs from *D. scandens* var. *paucifolia* by small differences in leaflet-number and flower-size which do not conceal the obvious close affinity. Taking these two pairs of forms as nuclei, it is possible to build up by accretion one series of five forms, *D. scandens* sens. lat., characterized by hooked calyx-teeth, ordinarily few leaflets (except var. *vulneraria*), ordinarily short calyx-tube (except var. *occidentalis*), and an eventually contracted, thyrsiform inflorescence; and a second, larger but still relatively homogeneous series of nine forms, *D. carthagenensis* sens. lat. which, despite much parallel variation, differs in its straight or nearly straight calyx-teeth, ordinarily many leaflets (with South American exceptions), and more effuse, corymbose-paniculate inflorescence. So constituted, *D. scandens* is dispersed from southern Texas to Nicaragua, extending around the Gulf of Mexico toYucatán and western Cuba, with outlying populations on the Pacific slope of the Mexican Plateau. It is entirely North American. The second centers on the Caribbean slope of northern South America and extends south into Peru and Bolivia, also north on the one hand through Puerto Rico and Hispaniola to peninsular Florida and on the other through central America to southern Mexico. It is only in its Mexican-Central American lobe that the range of *D. carthagenensis* overlaps that of *D. scandens* and in this region they are abruptly distinguished by easily observed calycine characters.

Key to the Species of Ser. *Thyrsiflorae*

1. Plants of Continental North and South America and of West Indies; *leaflets* usually flat or only shallowly navicular, but either membranous or carnosulous.
   2. Leaflets of primary cauline leaves (caution: not always present at anthesis) 7–12 (15) pairs, commonly glabrous, thick-textured, and small (1–6, rarely 7 mm long), the 3 terminal leaflets inserted at tip of rachis forming an exact trefoil; *petals* opening relatively vivid greenish- or citron-yellow (often red-margined), turning brownish-purple; *inflorescence* corymbose, all or almost all the spikes terminal to developed branchlets and most of them pedunculate; *calyx* densely pilose from base upward; highlands of s. Mexico, from México to extreme w. Veracruz, s. to Oaxaca. 137. *D. zimapanica* (p. 509)
   2. Leaflets of primary cauline leaves (with same reservation) 3–8 pairs, if more than 8 pairs then remotely allopatric to the last, very commonly submembranous, flat, and larger the preceding, if as small then decisively fewer, the odd

leaflet (of most or all leaves) shortly elevated above the last pair, thus forming a pedate trefoil; *petals* opening greenish-yellow or ochroleucous, not vivid yellow, early rubescent or nigrescent; *inflorescence* corymbose in some S. American forms, but in Mexico variously contracted into a spiciform or thyrsiform panicle, the majority of spikes (after the lowest, often pedunculate) sessile; widespread, but where approaching the range of *D. zimapanica* the foliage usually pubescent and ample, or the calyx-tube glabrescent, or the leaflets decisively fewer, larger, or both.

3. Dorsal calyx-tooth straight or obscurely sigmoid, the tip erect or very slightly incurved; *calyx-tube* 2.5–3.4 mm long or, when less, the teeth perfectly straight or the range different, or both; *calyx-tube* pubescent from base upward; Mexico s. from the Balsas Depression and s. through Central America to Peru and Bolivia; s. Florida and West Indies (but not Cuba). 139. *D. carthagenensis* (p. 513)

3. Dorsal calyx-tooth uncinate at tip; *calyx-tube* mostly 1.8–2.4 mm long (longer in Pacific Mexico, but the teeth there very strongly hooked); *calyx-tube* either pubescent or glabrous externally, but in the common range with *D. carthagenensis* usually glabrous and always shorter; w. margins of Gulf of Mexico from s. Texas to Yucatán and w. Cuba, s. through s.-e. Mexico and Central American highlands to Nicaragua; disjunct in Pacific Mexico from s. Sonora to Jalisco. 141. *D. scandens* (p. 525)

1. Plants of Islas Galápagos; *leaflets* of primary cauline leaves 7–9 pairs, mostly very small, carnosulous, conduplicate 2.5–4.5 (8) mm long; *spikes* at first (few) pedunculate and leaf-opposed, the majority sessile or subsessile and terminal to axillary short-shoots clad in short, crowded smaller leaves with only 3–6 pairs of leaflets; *calyx* of *D. carthagenensis*, the tube densely pilose, the teeth straight. 140. *D. tenuicaulis* (p. 524)

137. DALEA ZIMAPANICA Schauer
(Plate CXXIV)

Slender shrubs up to 2.5 m tall, sometimes flowering precociously when feebly suffruticose and only 0.5 m tall, usually becoming bushy and many-stemmed, or finally subarborescent, commonly glabrous to the inflorescence but the young branchlets and foliage sometimes pilosulous with sparse spreading hairs, the young stems castaneous, purplish, or rarely stramineous, smooth or thinly verruculose distally, each major cauline axis virgate below, paniculately branched distally, each branchlet terminating in a short, densely silky-pilose spike of calyces, the whole inflorescence broadly corymbose; *leaf-spurs* 0.2–0.9 mm long; *stipules* subulate, often livid or castaneous, 0.4–1.6 mm long; *intrapetiolular gland* conic; *post-petiolular glands* larger, prominent; *leaves* subsessile or very short-petioled, the primary cauline ones 2–4.5 (5) cm long, with margined rachis and 7–12 (15) pairs of oblong, elliptic-oblong, or obovate, emarginate to gland-apiculate, thick-textured, flat or navicular leaflets 2–6 (7) mm long, the leaves of the upper branchlets (sometimes of all present at anthesis) shorter, with as few as 4–8 pairs of generally smaller leaflets, all green above, paler or glaucescent and prominently gland-dotted beneath; *peduncles* 0.3–3.5 (4.5) cm long, the early ones always well-developed, the later short but usually evident, only the ultimate and smallest heads of each division of the panicle sessile or almost so; *spikes* moderately dense, ovoid-conical becoming subglobose or the larger ones shortly oblong-cylindroid, without petals 10–13 mm diam, the densely pilosulous axis 3–18 (25) mm long; *bracts*

deciduous, lanceolate, 2–5.5 mm long, castaneous or pallid at base, green, livid, or purplish distally, gross-glandular dorsally, the lowest, sometimes all, glabrous on back, but always ciliolate below middle, the rest usually pilosulous dorsally to middle, thence glabrate; *calyx* (4.1) 4.5–7.7 mm long, densely pilose with ascending, at length widely spreading, golden hairs up to (0.7) 0.8–1.35 mm long, the tube (2.1) 2.2–2.6 mm long, the salient ribs brownish, the membranous intervals charged with 1 (sometimes irregular) row of yellowish glands, the teeth subulate-aristate from a deltate-triangular base, unequal, the dorsal ones longest, (2) 2.3–5.3, mostly 3–4 mm long, hence longer (rarely to 0.2 mm shorter) than tube, all gland-spurred, plumose, stellately spreading in fruit; *petals* yellow or greenish-yellow edged with red or reddish-brown, all or at least the keel and wing-tips fading dull purple, all charged at apex with a large, linear-elliptic gland. the blade of banner sometimes sparsely gland-sprinkled, the episte-monous petals perched low on the androecium (± 1.1–1.7 mm above hypanthium; *banner* (4.2) 4.6–6.8 mm long, the claw (1.7) 2–3.2 mm, the deltate-cordate blade (2.4) 2.6–4 mm long, 2.6–3.8 mm wide, the small basal lobes incurved and adherent, forming lateral pockets; *wings* 4.9–7.1 mm long, the claws 1.3–2.1 mm, the broadly lance-oblong blades 3.6–5.6 mm long, 1.8–3 mm wide; *keel* (6.2) 7–8.8 mm long, the claws (2) 2.4–3.5 mm, the obliquely ovate blades (4.6) 4.8–6 mm long, 2.6–3.5 mm wide; *androecium* 10-merous, (6) 6.5–8.3 mm long, free for up to 1.7–2.2 mm, the connective gland-tipped, the anthers 0.65–0.8 mm long, the alternate ones sometimes much smaller; *pod* triangular in profile, 2.4–2.7 mm long, the style at corner, the prow slender but salient, the valves hyaline in lower ⅓, thence thinly papery, gland-sprinkled, and densely pilosulous distally; *seed* 1.6–1.8 mm long. — Collections: 58 (ix).

Dry hills and terraces of barrancas, becoming abundant on over-grazed and gullied grassland, mostly between 1650 and 2700 m, common on the plateau from Valley of Mexico (Distrito Federal and adjoining Estado) e. through Tlaxcala and centr. Puebla just into Veracruz (descending in valley of Orizaba to 1200 m), s. in México to the margins of Balsas Depression, not recorded from Morelos, but again common s.-ward in Puebla to Tehuacán desert and through the foothills of Mixteca Alta to the valley of Oaxaca. — Flowering September to January. — *Representative*: MÉXICO. Distrito Federal: *Bourgeau 327* (F, L, M, NY, P); *Pringle 9078* (F, GH, K, NY); *Purpus 5652* (F, NY, UC); *Ripley & Barneby 14,911* (CAS, DAO, NY, US). Naucalpan: *Bolaños 2550* (ENCB); Huixquilucan: *Rzedowski 21,526* (ENCB); *Pringle 4325* (BR, F, GH, K, NY, UC, W, Z). Villa Guerrero: *Matuda 27,893* (NY). Ixtapan de la Sal: *Matuda 27,430* (NY). Ixtapaluca: *Matuda 18,593* (NY). TLAXCALA. Calpulalapam: *Ripley & Barneby 13,633* (CAS, NY, MEXU, US). Tlaxcala: *Ripley & Barneby 13,635* (CAS, NY, MEXU). PUEBLA. Puebla: *Arsène 1201* (US). Tepeaca: *Arsène 3596* (BR, L, NY, Z). Amozoc: *Arsène 1907* (BR, NY). Cholula: *Nicolás in 1902* (BR, F, L, Z). Tehuacán: *Purpus 5648* (F, NY, UC). VERACRUZ. Acultzingo: *Ripley & Barneby 14,743* (CAS, NY, US). Orizaba: *Arsène 1667* (L). OAXACA. Huajuapan de León: *Ripley & Barneby 13,652* (CAS, NY, US). Teposcolula: *Seler 1553* (US). Etla: *Conzatti 2044* (F). Ixtlán de Juárez: *Gentry 12,064* (MEXU, RENNER). Mitla: *Ripley & Barneby 14,617* (NY). Miahuatlán: *Ripley & Barneby 14,630* (CAS, MEXU, MICH, NY, US).

Dalea zimapanica (of Zimapán, Hidalgo, but not now known there) Schauer, Linnaea **20**: 746. 1847. — "In circuitu urbis Zimapan in Mexico. *Aschb. n.* 460." — Holotypus, formerly B, not seen, but the protologue decisive. — *Parosela zimapanica* (Schauer) Rydb., N. Amer. Fl. **24**: 109. 1920.

(?) *Dalea lanata* (woolly, of the spikes) G. Don, Gen. Hist. Dichl. Pl. **2**: 224. 1832. — "Native of Mexico." — Holotypus, formerly herb. Lambert., not known to survive. Non *D. lanata* Spreng., 1826.

Psoralea luteola (yellowish) S. & M., Pl. Nov. Hisp. 121. 1889. — "Habitat in Sancti Angeli oppido ad rivulorum margines." — Presumed isotypus, "*Dalea luteola* misit Pavon 1827", P! potentially isotypic are *Herb. S. & M. 2666 p. p.*, F, MA! and "*Dalea lutescens* sp. nov. de Mexico", probably ex herb. Lambert. but not annotated by G. Don, OXF! (this conceivably holotypus of *D. lanata* G. Don).

Parosela diversicolor (of different hue) Rydb., N. Amer. Fl. **24**: 109. 1920. — "Type collected in Sierra de Clavellinas, State of Oaxaca, October 1894, *Charles L. Smith 549...*" — Holotypus, US! isotypus, NY!

Except in southern Puebla and Oaxaca, where its range coincides with that of *D. carthagenensis* var. *capitulata*, this is the only member of ser. *Thyrsiflorae* found in arid interior southern Mexico; it is readily recognized by the shrubby habit, many small leaflets of thick texture, repeatedly branching, finally corymbose inflorescence of many subcapitate spikes, and yellow petals tinged with red around the exterior margins and tipped with large elliptic or crescentic blister-glands. The var. *capitulata* differs in its fewer leaflets, of primary cauline leaves 4–8 not 7–12 or 15 pairs, and in the spicate-thyrsiform arrangement of the flower-heads. The petals open creamy or greenish-creamy rather than the rich yellow of *D. zimapanica*, but fade a similar dull pinkish-brown or maroon purple. Other shrubby, yellow-flowered daleas of the region have longer flower-spikes, or (*D. lutea*) persistent interfloral bracts, or (*D. melantha*) much fewer leaflets, or some combination of these differences.

Rydberg (1920, p. 109) described *D. zimapanica* as glabrous below the flower-spikes, and this is true of the majority of populations known in the valley of Mexico. Occasionally, however, young branchlets and upper leaves, rarely all leaves, are thinly puberulent, but these occur sporadically, sometimes near the glabrous form (as at Ixtapan de la Sal, *Ripley & Barneby 13,765, 13,757*, NY). An extreme form from Sierra Madre del Sur in Oaxaca (near Miahuatlan, cited above) has both stems and foliage pilosulous with widely spreading hairs up to 0.3–0.4 mm long. These plants are further unusual in having short calyx-teeth (2–2.7 mm), plumose with relatively short hairs; but the variation is of a sort to be expected among the polymorphic and unstable *Thyrsiflorae* and is not considered taxonomically significant. The petals of *D. zimapanica* vary somewhat in size, but the typus of supposedly large-flowered *P. diversicolor* can be matched in this respect by material from the Valley of Mexico; it seems to represent nothing more than a vigorous and showy minor variant.

A notable individual plant (s. of Matatlán, at s. end of vale of Oaxaca, *Ripley & Barneby 14,618*, CAS, NY), found growing among prolific thickets of *D. zimapanica* and *D. leucosericea*, is thought to be a hybrid between these associated but not closely related species. The foliage of the hybrid is intermediate in leaflet-number (4–6 pairs) and is pubescent with a thin soft vesture suggesting that of *D. leucosericea* but thinner; and the yellow, finally reddish-brown flowers are almost those of *D. zimapanica* but are disposed in relatively long and loose spikes.

The nomenclature and synonymy of *D. zimapanica* are clouded by the destruction or dispersal of type-specimens. The original collection of Aschenborn is presumed lost in the Berlin disaster, but Schauer's protologue is precise and detailed, leaving little room for doubt as to his intentions. It is disturbing only in so far that the species was not encountered near Zimapán (or elsewhere in Hidalgo) by other early botanists who visited this well-botanized locality, and has been sought there vainly in recent years. The identity of *Psoralea luteola* appears firmly established by means of the original description and by coincidental existence (even though only tenuous proved connection with) specimens in the Sessé herbarium and others distributed, probably from the same source, by Pavón. Due to brevity of the protologue, doubt remains as to the application of *D. lanata* G. Don, but as this is a later homonym, the problem is academic. The plant at OXF labelled *Dalea lutescens sp. nov. de Mexico*, which is mounted in the style of others known to have been part of the Lambert herbarium, is a good even though unprovable candidate for the

missing typus of *D. lanata*, but the discrepancy in epithets (*lutescens* seems a likely variant of *luteola*, found in a Pavón specimen at P) cannot be explained.

138. DALEA TOLTECA Barneby
(Plate CXXIV)

Fruticose but of unknown stature, glabrous to the inflorescence, the older stems furrowed, the stramineous, remotely low-tuberculate younger branches paniculately branched upward, the foliage bicolored, the leaflets green above, glaucescent and gland-sprinkled beneath; *leaf-spurs* 0.4–0.8 mm long; *stipules* subulate, subglandular, 1–2 mm long; *intrapetiolular gland* 1, small; *post-petiolular glands* prominent, conic or prickle-shaped, orange; *leaves* short-petioled, the primary cauline ones 2.5–3.5 cm long, with margined rachis and 9–14 pairs of elliptic-obovate, obtuse, bluntly gland-mucronate, flat leaflets 3–5.5 mm long, the rameal leaves reduced in size distally, with smaller and fewer leaflets; *peduncles* leaf-opposed and terminal to branchlets, often curved outward, 1.5–3.5 cm long; *racemes* spiciform, relatively loose, ± 15–30-flowered, the calyces falling when pressed into 2–3 ranks, not concealing the softly pilosulous axis, this finally 1.5–3 cm long; *bracts* deciduous, narrowly lance-acuminate, 3–4 mm long, toward base keeled and at each edge membranous-margined, distally flat, subherbaceous, and ciliolate, dorsally glabrous and charged with a few glands; *pedicels* obscure, 0.1–0.2 mm long; *calyx* 4.3–4.5 mm long, the tube 2.6–2.7 mm, firm, lustrous, glabrous externally or thinly villosulous with hairs up to 0.3–0.5 mm long, the ribs slender but salient, the intervals charged with 2–3 small blister-glands, the teeth triangular- or broadly lance-acuminate, subequal, the dorsal one 1.7–1.9 mm long, all nigrescent, gland-spurred, softly ciliolate on margins, dorsally glabrous or pilosulous, pubescent within; *petals* (not seen fresh) apparently opening pale yellow (or the inner perhaps faintly roseate), all fading dull brownish-purple, the banner and keel tipped with small glands, the banner gland-sprinkled, the epistemonous ones perched low on androecium (1.2–1.8 mm above hypanthium); *banner* 4.8–6 mm long, the claw 2.3–3.2 mm, the ovate-deltate, basally cordate blade 2.8–3 mm long, 3–3.6 mm wide, recessed at top of claw into a shallow cornet; *wings* 4.7–5.3 mm long, the claw 1.5–1.7 mm, the narrowly oblong-oblanceolate blade 3.5–3.8 mm long, 1.4–1.7 mm wide; *keel* 6.6–7.2 mm long, the claws 2.3–2.7 mm, the blades 4.4–5.2 mm long, 2.6–3 mm wide; *androecium* 10-merous, 6.5–8.2 mm long, the longer filaments free for 2.5–2.8 mm, the connective gland-tipped, the anthers 0.55–0.7 mm long; *pod* unknown. — Collections: 3 (o).

Habitat little known, in the type-locality among brush colonizing the slopes of an artificial hill, ± 2225 m, collected twice on the Teocalli de Cholula, Puebla, once on Cordillera de Yavezia in n.-centr. Oaxaca. — Flowering November to January. — *Material*: PUEBLA: Cholula, *Arsène 1645* (BR, US). OAXACA: "Sierra Oaxaca" or "Cord. Yavezia," *Galeotti 3152* (BR, W).

Dalea tolteca (of Toltec nation) Barneby, sp. nov., *D. zimapanicae* Schau. forsan propiuscule affinis sed spica subracemosa laxa necnon calyce brevidentato extus infra dentes glabro vel glabrescenti distincta. — Verosimiliter frutices, praeter spicas racemiformes glabri; *folia* primaria 2.5–3.5 cm longa, foliolis 9–14-jugis obovato-ellipticis planis 3–5.5 mm longis; *racemi* laxe paniculatim dispositi oppositifolii ac terminales laxe 15–40-flori, floribus brevissime pedicellatis bractea mox caduca suffultis; *calyx* extus infra dentes glaber vel parce breviter pilosulus, tubo 2.6–2.7 mm longo dentibus triangulari-acuminatis

saltem paullo longiori; *petala* primum luteola mox carnescenti-brunnescentia; *carinae* 6.6–7.2 mm longae laminae 4.4–5.1 mm longae. — PUEBLA. Cholula: Teocalli de Cholula, 2224 m, Nov. 7, 1907, *Arsène 2049*. — Holotypus, NY; isotypi, GH, US.

A curious and distinctive dalea, beset by problems of interpretation at present insoluble. The species seems to be related to *D. zimapanica*, but differs in the loose racemes of short-toothed, externally glabrous or glabrescent calyces raised on definite even though very short pedicels. The flower-color of *D. tolteca* is not known from direct observation, but Galeotti noted "flores lutei" in Oaxaca, and the material from Puebla appears to have had petals pale yellow fading dull pinkish-brown, of about the same gamut as in *D. melantha* var. *berlandieri*. There is no hint of the red margin so often seen around the wing- and keel-tips in *D. zimapanica*.

Granted that the data associated with the specimens is correct (a somewhat risky assumption in this particular case), three daleas were collected by Arsène and Nicolás on the pyramid of Cholula in November 1909. One of these, *Nicolás s. n.* (BR, F, L, Z) is typical *D. zimapanica*; the other two, cited above, *D. tolteca*, the holotypus with calyx glabrous externally, and the topotypus with calyx thinly pilosulous distally. The coincidence of sympatry and variability in pubescence suggests that *D. tolteca* is a hybrid derived from *D. zimapanica*, but no likely candidate for the second parent is known to occur near Puebla. Cholula was a celebrated shrine for centuries prior to the Conquest, and the appearance of an alien on the slopes of the pyramid visited by pilgrims from distant parts of Mexico would not be extraordinary. There is no reason to suppose that the plant collected by Galeotti in Oaxaca was anything but native, but there is no confirming modern collection, so that we really know almost nothing about the true dispersal of *D. tolteca* and speculation is fruitless. Variation in dispersal of the trichomes is a feature so common among presumed relatives of *D. tolteca* that even a small random smaple might well include some evidence of it.

139. DALEA CARTHAGENENSIS (Jacquin) Macbride
(Plates CXXV–CXXVII)

Slender shrubs, sometimes flowering precociously as suffrutescent herbs, becoming 6–20 dm tall, freely and repeatedly branched upward, the pale brown or purplish branches sparsely verruculose, the young stems and foliage varying from densely villosulous or silky-pilosulous to glabrous, the inflorescences always villosulous to silky-barbate, the leaflets ± bicolored, the upper surface green (rarely silvery-pubescent), the lower paler and punctate; *leaf-spurs* less than 1 mm long; *stipules* narrowly triangular-subulate, firm, 0.6–1.5 mm long, often puberulent; *intrapetiolular glands* 2, variable in size; *post-petiolular glands* prominent; *leaves* dimorphic, the primary cauline ones drought-deciduous, sometimes already fallen by anthesis, shortly petioled or subsessile, 1.5–7 cm long, with narrowly margined rachis and (7) 9–17, more rarely up to 25 obovate, broadly elliptic, ovate-oblong, or oblong-elliptic, obtuse or emarginate, sometimes gland-mucronate, flat leaflets 4–18 (20) mm long, the leaves of axillary spurs and short-shoots small, with fewer and often smaller leaflets; *spikes* numerous, usually both pedunculate and sessile, sometimes all sessile, the leaf-opposed peduncles produced early in the season terminal to primary divisions of the panicle, up to 1–3.5 cm long, the sessile spikes mostly terminal to axillary, often greatly condensed short-shoots, the whole inflorescence either loosely cymose-paniculate or virgate-spiciform; *spikes* either loose, the flowers falling into ± 3 ranks when pressed, or remaining dense and capitate (but not conelike), (3) 5–30-flowered, the villosulous axis becoming 2–20 (30) mm long; *bracts* tardily deciduous, ovate-acuminate or -cau-

date, clasping the base of calyx, 2.3–6.5 mm long, firm, dorsally gross-glandular and either villosulous or medially glabrescent; *calyx* mostly 5–8.8 mm, in South American forms sometimes only 3.8–6 mm long, villosulous from base upward or the tube glabrescent, the teeth always plumose-plumulose with finally spreading hairs up to 0.6–1.1 mm long, the tube (measured to a dorsal sinus) 2–3.4 mm long, its orifice oblique but not recessed abruptly behind banner, the ribs prominent, the intercostal membranes charged with 2–8 small, distinct, either prominent and blisterlike or immersed and externally invisible glands, the triangular-aristate, straight or slightly sigmoid, gland-spurred teeth erect or eventually stellate, subequal in length, the dorsal one (1.5) 2.2–5.6 mm long, in North America always and in South America usually as long or much longer than tube; *petals* greenish-white or -cream at early anthesis, soon fading dull brownish-purple or maroon, the epistemonous ones perched well below middle of androecium, all (or all but wings) charged with a prominent subapical gland, the eye of the banner usually gland-sprinkled; *banner* 3.1–6.4 mm long, the claw 1.4–2.8 mm, the deltate-cordate, ± hooded blade 1.7–5.7 mm long, 1.7–3.7 mm wide, recessed at base into an at least shallow cornet; *wings* 3.3–5.3 mm long, the claw (0.9) 1–1.6 mm, the obliquely ovate-oblong blade 2.3–4.2 mm long, 1.2–2 mm wide; *keel* (4) 4.2–8.1 mm long, the claws (1) 1.4–3.2 mm, the obliquely ovate or half-obovate blades 2.3–5.7 mm long, 1.4–3.2 mm wide; *androecium* 10-merous, 5.2–9 mm long, the filaments cleft into a short tassel, the connective prominently gland-tipped; *pod* deltate or triangular-obovate in profile, 2.3–2.7 mm long, the ventral suture straight or notched at the pore, the style terminal or at the corner, the prow subfiliform, the valves hyaline in lower half, thinly papery, densely gland-sprinkled and villosulous distally.

A polymorphic species of immense, discontinuous dispersal, very closely related to *D. scandens*, from which it cannot be separated by any one known differential character of substance. The problem is discussed under the heading of ser. *Thyrsiflorae*. Nine geographic races are described in the following pages, and are most conveniently separated by an artificial key based in the first instance on factors of dispersal.

Key to the Varieties of *Dalea carthagenensis*

1. Plants of the northern hemisphere (s. Colombia n.-ward).
   2. Of s. peninsular Florida; *leaflets* of primary cauline leaves 15–25.
      139d. var. *floridana*.
   2. Of West Indies and Mexico s.-ward; *leaflets* mostly 11–15 (except var. *isthmicola* of s. Mexico).
      3. Southern Mexico, from the Neo-volcanic belt to Isthmus of Tehuantepec.
         4. Michoacán to Puebla, s. to centr. and s.-e. Oaxaca; *leaflets* of primary cauline leaves (7) 9–15 (17); *keel-blades* 3.7–4.4 mm long.
            139e. var. *capitulata*.
         4. Isthmus of Tehuantepec, s.-e. Oaxaca; *leaflets* 19–25; *keel-blades* ± 5 mm long.
            139f. var. *isthmicola*.
      3. Central America, extending into Chiapas, Mexico, s. to Colombia and Venezuela, and Caribbean.
         5. Puerto Rico only; *keel-blades* 2.3–3.6 mm long.
            139c. var. *portoricana*.
         5. Hispaniola, Virgins Is., and s.-ward; *keel-blades* mostly 4–5.7 mm long, in the West Indies decisively larger than in the last.

6. Intercostal glands of calyx blister-like, in dried material readily visible externally; lowland n. Colombia and n. Venezuela, Hispaniola, and Virgin Is. 139a. var. *carthagenensis*.
6. Intercostal glands of calyx small, often transparent or pale, immersed or masked by pubescence; Central America, from Chiapas to Panama, disjunctly in Andean Colombia. 139b. var. *barbata*.

1. Plants of the southern hemisphere (s. Ecuador s.-ward).
7. Peru and Ecuador; *leaflets* of primary leaves 9–17; *axis* of spikes 3–11 mm long.
8. Inter-Andean centr. and n. Peru, there and in Ecuador coming out to the cismontane slope and coast; *foliage* green, glabrous or inconspicuously villosulous. 139g. var. *brevis*.
8. Cismontane Peru from La Libertad s. to Huancavelica; *foliage* densely persistently gray-silky. 139h. var. *trichocalyx*.
7. Bolivia, on e. margin of the Andean plateau in dept. La Paz; *leaflets* of primary leaves 7–9 (11); *axis* of spikes 7–25 mm long. 139i. var. *pilocarpa*.

139a. DALEA CARTHAGENENSIS (Jacquin) Macbride var. CARTHAGENENSIS (Plate CXXV)

Either glabrous up to the inflorescence or villosulous throughout; *primary cauline leaves* 3–7 cm long, with (9) 11–17 leaflets 5–18 (20) mm long; *early peduncles* 1–3.5 cm, later ones 0–1 cm long; *bracts* 3–5.5 mm long; *calyx* (5.8) 6.2–7.4 mm long, the tube (2.5) 2.6–3.4 mm, the intercostal glands mostly 3–5, small, discrete, the straight teeth 3–4.8 mm long; *banner* 4–6.4 mm long; *keel* 5.8–8 mm long, the claws 1.7–3 mm, the blades (3.7) 4.4–5.7 mm long, (1.9) 2.1–3.2 mm wide; *androecium* 6.2–9 mm long. — Collections: 46 (o).

Thickets near the coast and on brushy hillsides up to ± 1000 m in the interior, locally abundant, Caribbean slope in n. Venezuela and Colombia; Lesser Antilles (Curaçao); Hispaniola (Haiti); Virgin Islands (St. John); in Puerto Rico represented by the next. — Flowering irregularly through the year. — *Representative*: HISPANIOLA. HAITI: *E. & G. Leonard 13,017* (NY); *E. Leonard 8930* (NY, UC). VIRGIN ISLANDS. ST. JOHN: *Eggers 3038* (UC). LESSER ANTILLES. CURACAO: *Britton & Schaefer 3143* (NY); *Benzon 277* (C); *Br. Arnoldo 1782* (US). VENEZUELA. LARA: *H. M. Curran 379* (NY). CARABOBO: *Alston 5885* (NY, US); *Pittier 8670* (NY, US). ARAGUA: *Pittier 5785* (F, NY, US), *11,351* (NY, US). DISTRITO FEDERAL: *Alston 5223* (F, NY, US); *Pittier 9922* (NY, US). MIRANDA: *Steyermark 54,981* (F). COLOMBIA. ATLÁNTICO: *Dugand & Jaramillo 4072* (NY, US); *Br. Elias 1345* (F, US). BOLÍVAR: *Pennell 4060* (F, NY, US); *Killip & Smith 14,448* (NY, US). MAGDALENA: *Haught 3869* (US); *H. H. Smith 2041* (F, NY, TEX, UC, US, WIS).

Dalea carthagenensis (Jacqu.) Macbr., Field Mus., Bot **13**: 375. 1943, based on *Psoralea carthagenensis* (of Cartagena) Jacqu., Enum. Syst. Pl. Carib. 27. 1760. — No locality given, but from the epithet evidently thought to come from Cartagena; based partly on *Colutea enneaphylla* etc. Plukenet, Phytographia tab. 166, fig. 2. 1691. — Holotypus, labelled "*Psoralea carthagenensis*. Herb. Jacquin.," W! — *Parosela carthagenensis* (Jacqu.) Killip, Jour. Wash. Acad. Sci. **26**: 359. 1936 ("*carthaginensis*", an incorrect spelling copied by Machride, 1943). *Dalea carthagenensis* subsp. *typica* R. T. Clausen, Bull. Torrey Club **73**: 572. 1946.

Psoralea enneaphylla (with nine leaflets) Jacqu. in Linn., Sp. Pl. ed. 3, 1076. 1764. — "Habitat in Indiis." — An apparent new proposition, but perhaps better interpreted as based on *Psoralea foliis pinnatis etc.* Jacqu. (= *Ps. carthagenensis* Jacqu.) and the Plukenet figure cited above, in which case a superfluous substitute. — *Dalea enneaphylla* (Jacqu.) Willd., Sp. Pl. **3**: 1338. 1802.

Psoralea emphysodes (blister-like, of the glands) Jacqu., Collectanea **4**: 144. 1790. — "Crescit ad Caracas." — Holotypus, labelled "*Psoralea emphysodes.* H[ort.] S[choenbrun.] Herb. Jacquin.," W! — *Psoralea phymatodes* (tumor-like) Jacqu., Ic. Pl. Rar. **3**: 13, pl. 563. 1792, a superfluous, possibly inadvertent substitute. *Dalea phymatodes* (Jacqu.) Willd., Sp. Pl. **3**: 1338. 1802. *Parosela emphysodes* (Jacqu.) Rydb., N. Amer. Fl. **24**: 113. 1920. *Dalea emphysodes* (Jacqu.) R. T. Clausen, Bull. Torrey Club **73**: 85. 1946. *D. emphysodes* subsp. *emphysodes* R. T. Clausen, Bull. Torrey Club **73**: 85. 1946.

Dalea domingensis (of Santo Domingo) DC., Prod. **2**: 246. 1825 ("*Domingensis*"). — "...in Sancto Domingo...comm. a cl. Balbis." — Holotypus, collected by Bertero, sent to DeCandolle by Balbis, G-DC! isotypi, from the same source, M, P! — *Parosela domingensis* (DC.) Millsp., Field Mus., Bot. **1**: 21. 1895; A. Heller, Cat. N. Amer. Pl., ed. 2, 6. 1900. *Dalea carthagenensis* subsp. *domingensis* (DC.) R. T. Clausen, Bull. Torrey Club **73**: 572. 1946.

Dalea domingensis (of Santo Domingo) Spreng., Syst. **3**: 327. 1826. — "*Hispaniola.* Bertero." — No typus seen, but probably based on an isotypus of *D. domingensis* DC.

The var. *carthagenensis* is variable in pubescence. Modern collections from prov. Bolívar in Colombia, whence the original *Psoralea carthagenensis* is thought to have come, are glabrous up to the spikes, as are the specimens in Jacquin's herbarium preserved under the latter name. The same glabrous form occurs on Curaçao, but the populations sampled from stations in Santa Marta have thinly pubescent leaves and branchlets, intermediate to the usually villosulous Venezuelan plant to which the name *Psoralea emphysodes* was originally given. The few records from the Magdalena valley in Colombia are likewise more or less pubescent.

The representatives of *D. carthagenensis* found on Hispaniola, which Clausen referred, together with our var. *floridana*, to a subsp. *domingensis*, thought to differ in hooked calyx-teeth, is scarcely different from the villous phase of the South American mainland. The teeth in the holotypus of *D. domingensis* are, moreover, straight, and in other collections seen from Hispaniola almost imperceptibly incurved distally. On the other hand it seems preferable to exclude from var. *carthagenensis* the Porto Rican elements assigned by Rydberg to *Parosela emphysodes*; these have the habit and glabrous foliage of strictly typical var. *carthagenensis* but differ consistently in their smaller flowers. Curiously, the one collection that I have seen from the Virgin Islands is not var. *portoricana*, but typical var. *carthagenensis*.

139b. DALEA CARTHAGENENSIS (Jacquin) Macbride var. BARBATA (Oersted) Barneby

(Plate CXXV)

Villosulous throughout, or the stems subglabrous and the mature leaflets finally glabrate; *primary cauline leaves* 2.5–7 cm long, with 11–15 (17) leaflets 5–16 mm long; *spikes* both pedunculate and (later) sessile, all subcapitate or the earlier ones a little elongating, the axis up to 2 but mostly less than 1 cm long; *bracts* 3–5.5 (6.5) mm long, villosulous dorsally; *calyx* densely silky-pilose, 6.2–8.8 mm long, the tube 2.6–3.3 mm long, the intercostal glands 2–4, small, distant, immersed or scarcely protuberant, often pale or transparent, concealed by vesture, the plumose teeth straight or finally stellately recurving, 3.5–5.6 mm long; *banner* 4.2–5.2 mm, the claw 1.7–2.8

mm, the blade 2.4–3.1 mm long; *keel* 6–7.8 mm long, the claws (1.7) 2–3.2 mm, the blades 4.2–5.1 mm long, (2.1) 2.4–2.8 mm wide; *androecium* 6–8.5 mm long. — Collections: 52 (o).

Savannas and thickets near sea-level, ascending in dry open places into pine-oak forest, reaching 2000 m in Guatemala, perhaps occasionally higher, very common locally in second-growth brush, sometimes weedy along highways and in hedges, widely dispersed through Central America, from highland Chiapas, Mexico, to Panama, and reappearing on upper Río Magdalena and Río Juanambu (Nariño), Colombia. — Flowering September to April (July), perhaps at intervals throughout the year. — *Representative*: MEXICO. CHIAPAS. Arriaga: *Juzepczuk 1380* (F). Cintalapa: *Purpus 10,328* (NY, UC). Tuxtla Gutiérrez: *Miranda 6735* (MEXU). Comitán: *Gentry 12,190* (MICH, RENNER). La Trinitaria: *Raven & Breedlove 13,209* (US). GUATEMALA. HUEHUETENANGO: *Friedrichstal 1173* (W). GUATEMALA: *Williams & Molina 15,282* (F). ZACAPA: *Kellerman 5986* (UC). JUTIAPA: *Standley 76,140* (F). EL SALVADOR. AHUACHAPÁN: *Standley & Padillo 2852* (F). SANTA ANA: *Standley & Padillo 3104* (F). MORAZÁN: *Tucker 587* (F, NY, UC, US). HONDURAS. COMAYAGUA: *Standley & Chacón 5914* (F). MORAZÁN: *Molina 3386, 3913* (F). EL PARAÍSO: *Standley 28,027* (F). CHOLUTECA: *Standley 15,895* (F). NICARAGUA. ESTELÍ: *Molina 23,099* (NY). JINOTEGA: *Standley 10,144* (F). MATAGALPA: typus. MANAGUA: *Br. Garnier 99* (US). GRANADA: *Levy in 1870* (C). COSTA RICA. GUANACASTE: *Molina et al. 26,381* (NY). SAN JOSÉ: *Pittier 1610* (BR, US). PUNTARENAS: *Valerio 1465* (F). PANAMA. VERAGUAS: *P. H. Allen 1601* (NY). COCLÉ: *Pittier 5100* (NY). PANAMÁ: *P. H. Allen 1139* (NY). COLOMBIA. CUNDINAMARCA: *Triana in 1851–7* (NY, US, W). HUILA: *Rusby & Pennell 368, 369* (NY, US). NARIÑO: *Triana in 1851–7* (BR, NY, US, W).

Dalea carthagenensis var. **barbata** (Oersted) Barneby, comb. nov., based on *D. vulneraria γ barbata* Oerst. Vidensk. Meddel. **1853**: 4. 1854. — "...i Provindsen Segovias Hoiland imellem Matagalpa og Chinotega i en Hoide af 3–4000 Fod..." — Holotypus, labelled "*Dalea vulneraria γ barbata*. Ad Matagalpa in Segovia", accompanied by 3 tickets: a) *Dalea* N. 6–7...; b) *Dalea* N. 5. Ad Ginotega in Segovia; c) *Liebmann* Pl. Mex. *4596*, this clearly modern and irrelevant. Tickets a and b are in Oersted's hand but probably only the first belongs with the specimen, which agrees perfectly with the protologue, C! isotypus (*Oersted 5, 6*), K! — *Parosela barbata* (Oerst.) Rydb., N. Amer. Fl. **24**: 116. 1920.

Dalea vulneraria α brevidens (short-toothed, of the calyx) Oersted, Vidensk. Meddel. **1853**: 4. 1854. — Data as for var. *barbata*. — (?) Holotypus, corresponding with the protologue but ticketed *β typica*, C!

This variety is very closely akin to the villous aspect of var. *carthagenensis*. The leaves and relatively ample flowers are the same, and the calyx is of the same size and proportions, but its intercostal glands are only feebly protuberant or fully immersed, as well as smaller and paler, scarcely discernible from external view. The variety is typically developed in Central America from Panama northward. In interior Colombia, between Cundinamarca and Nariño, there occurs a form in which the densely long-pilose calyx of var. *barbata* is combined with small but highly colored, often readily visible glands. This is referred somewhat arbitrarily to var. *barbata*, but is intermediate to var. *carthagenensis*. In the northern part of its range, from Nicaragua northward, var. *barbata* is sympatric with and perhaps sometimes directly associated with *D. scandens* var. *vulneraria*, similar in general appearance but different in the short calyx-tube (1.8–2.5, not 2.6–3.2 mm long) that is glabrous externally or almost so and charged with 1–3 very big, often confluent blister-glands and in the strongly hooked calyx-teeth.

139c. Dalea carthagenensis (Jacquin) Macbride var. portoricana Barneby (Plate CXXV)

Glabrous or nearly so up to the spikes, the young branchlets and leaf-rachis thinly villosulous; *primary cauline leaves* 2.5–6.5 cm long, with 11–15 leaflets 4–13 mm long; *peduncles* terminal to main divisions of the panicle commonly developed, up to 1–2 cm long, the rest (rarely all) very short or 0; *spikes* loose, mostly 10–30-flowered, the villosulous axis becoming (5) 10–30 mm long; *bracts* 2.5–4.5 mm long, thinly villosulous or glabrate dorsally; *calyx* 5–6.9 mm long, villosulous throughout, the tube 2.5–2.7 mm, the intercostal glands 3–5, relatively small, the teeth (2.4) 3–4 mm long; *banner* 3.5–4 mm, the claw 1.5–2 mm, the blade 1.7–2.1 mm long; *keel* 4.2–5.8 mm long, the claws 1.9–2.4 mm, the blades 2.3–3.6 mm long, 1.4–2 mm wide; *androecium* 5.3–6.5 mm long. — Collections: 12 (o).

Dry hills and thickets near the coast, here and there along the s. coast of Puerto Rico. — Flowering November to April. — *Representative*: *Alain 9025* (NY); *Britton, Britton & Brown 5989* (NY); *Britton & Shafer 1798* (NY); *Sintenis 3538* (M).

Dalea carthagenensis (Jacqu.) Macbr. var. **portoricana** (of Puerto Rico) Barneby, var. nov., a var. *carthagenensi* floribus minoribus, carinae laminis 2.3–3.6 (nec 6.5–9) mm longo, caeterius var. typicae formis austro-americanis glabriusculis praesimilis. — Puerto Rico: inter Coamo et Salinas, 9 dec 1885, *P. Sintenis, Pl. Portoricenses 2986*. — Holotypus, NY; isotypi BR, M, UC, W.

Material of var. *portoricana* was associated by Urban (in herb.) and by Clausen (1946) with the similar plant of Hispaniola, but was referred by Rydberg (1920, p. 113) to the Venezuelan *Parosela emphysodes*. It differs from both of these entities, which are combined herein under the name var. *carthagenensis*, in its small keel-blades and correspondingly short androecium. As already noted, the representative of *D. carthagenensis* found on St. John Island in the Virgins (listed by Britton, Mem. Brooklyn Bot. Gard. **1**: 53. 1918, as *Parosela domingensis*) is surprisingly also var. *carthagenensis*, not var. *portoricana*.

139d. Dalea carthagenensis (Jacquin) Macbride var. floridana (Rydberg) Barneby (Plate CXXV)

Villosulous throughout, or the leaves and twigs rarely glabrescent, exceptionally glabrous; *primary cauline leaves* 3–5.5 (7) cm long, with 15–23 (25) leaflets 4–12 (14) mm long; *peduncles* terminal to main divisions of the panicle up to (3) 5–25 mm long, succeeding ones shorter or 0; *spikes* loose, 5–15 (20)-flowered, the villosulous axis becoming (2) 4–15 (20) mm long; *bracts* (2.5) 3–5 mm long, dorsally villosulous or glabrescent at middle; *calyx* (5.2) 5.5–7 mm long, villosulous from base upward, the tube (2.4) 2.6–3.2 mm, the teeth 2.6–4 mm long, straight or obscurely incurved at tip; *banner* 4.2–5.2 mm long, the claw 1.7–2.2 mm, the blade 2.5–3.4 mm long, 2.6–3.4 mm wide; *keel* (5.5) 5.8–6.8 mm long, the claws (1.8) 2–2.6 mm, the blades 4–5.4 mm long, (2) 2.2–3 mm wide; *androecium* (6.2) 6.5–8.5 mm long. — Collections: 16.

Pineland and hammocks, sometimes on coral rock, coming out to road-sides and canal-banks, below 15 m, apparently common locally in Palm Beach, Dade, and Monroe counties, s. peninsular Florida. — Flowering November to May. — *Representative*: Florida. Palm Beach: *Curtiss 5374* (NY, UC); *Small 8512* (NY). Monroe: *Moldenke 346* (NY). Dade: *Moldenke 3786* (NY); *Small 4071, 4083, 4762* (all NY).

Dalea carthagenensis (Jacqu.) Macbr. var. **floridana** (Rydb.) Barneby, stat. nov., based on *Parosela floridana* (of Florida) Rydb., N. Amer. Fl. **24**: 114. 1920. — "Type collected at Miami, Florida, November, 1878, *A. P. Garber*..." — Holotypus, NY! isotypi (5), NY!

The var. *floridana* was equated by Small (Fl. S. E. U. S. 628) with the Antillean *D. domingensis*, and subsequently was reduced by Clausen (1946, p. 85) to a homonymous subsp. of *D. emphysodes*. It is obviously closely akin to the races of *D. carthagenensis* found on Hispaniola and Puerto Rico, but differs from both in the more numerous and, on the average, smaller leaflets in the primary cauline leaves. These leaves are, as in all forms of the species, drought-deciduous, with the result that specimens collected toward the end of the dry season, in April or May, simulate the genuine var. *carthagenensis* of Hispaniola, but comparison of plants collected in the fall months demonstrate a clear and constant difference in leaflet-number. The foliage of var. *floridana*, like that of var. *carthagenensis* in Colombia and Venezuela, varies from densely villosulous to glabrous, although the latter state is comparatively rare and seldom collected (cf. *Moldenke 346*, already cited). This variation in pubescence within the context of a geographically constricted entity is especially noteworthy, as it exemplifies and foreshadows the instability in this feature that runs through the whole of sect. *Thyrsiflorae*.

139e. Dalea carthagenensis (Jacquin) Macbride var. capitulata (Rydberg) Barneby

(Plate CXXVI)

Shrubs to 1–2 m tall with pliant branches, appearing glabrous to the spikes, but young twigs and leaves of short-shoots thinly villosulous; *primary cauline leaves* (1) 1.5–4.5 cm long, often lacking from flowering material, with (7) 9–15 (17) leaflets (3) 4–10 (12) mm long; *spikes* all subcapitately few-flowered, the earliest terminal to main branches shortly pedunculate, the majority terminal to axillary spurs and appearing sessile, the whole inflorescence becoming an interrupted spike of depressed-globose to low-ovoid heads 10–13 mm diam, the axis of each 2–7 mm long; *bracts* 2.3–4 mm long, the lowest sometimes glabrous dorsally but ciliate, the rest villosulous dorsally; *calyx* silky-pilose all over, 5.3–7.6 mm long, the tube 2.1–2.4 mm, the intercostal glands (3) 4–8, small, distinct but prominent, the straight, plumose teeth 3.1–5 mm long; *banner* 3.1–3.8 mm, its claw 1.4–1.8 mm, its blade 1.7–2.4 mm long; *keel* 4.9–5.9 mm long, the claws 1.5–1.8 mm, the blades 3.7–4.1 (4.4) mm long, 2–2.4 mm wide; *androecium* 5.2–6.7 mm long; 2n = 14 (Mosquin). — Collections: 21 (vi).

Arid hills and valley floors, on a variety of sedimentary, volcanic, and alluvial soils, locally very abundant, forming large associations sometimes crowded into thickets, 700–1560 m (2700–5200 ft), arid interior lowlands of s. Mexico, around the n.-w. periphery of Balsas Depression in e. Michoacán, s.-w. México and Puebla, e. to the Tehuacán Desert and headwaters of Río Papaloapan in Puebla, and especially common in the valley of centr. Oaxaca; one record from Tehuantepec (Cerro Pozorio). — *Representative*: Michoacán. Tiquicheo: *Moore et al. 5705* (BH, MEXU, UC). México. Temascaltepec: *Hinton 7564* (ARIZ, F, NY, Z), *8572* (ARIZ, F, NY, US, W, Z). Puebla. Tehuitzingo: *Ripley & Barneby 14,573* (CAS, GH, MEXU, MICH, NY, US). Tehuacán: *Purpus 461* (GH, UC). Coxcatlán: *Ripley & Barneby 14,722* (CAS, DAO, NY). Zapotitlán de Salina: *Ripley & Barneby 14,716* (NY). Oaxaca. Tomellín: *L. C. Smith 443* (GH). Etla: *Ripley & Barneby 14,614* (NY). Oaxaca de Juárez: *Conzatti 1675* (GH, OKLA); *Liebmann 4615* (F). Miahuatlán: *Ripley & Barneby 14,644* (NY).

Dalea carthagenensis (Jacqu.) Macbr. var. **capitulata** (Rydb.) Barneby, stat. nov., based on *Parosela capitulata* (with small headlike spikes) Rydb., N. Amer. Fl. **24**: 113. 1920. — "Type collected in Oaxaca, December 8, 1901, *Conzatti & Gonzalez 1262...*" — Holotypus, GH! clastotypus (fragm.), NY! — *D. capitulata* (Rydb.) Harms, Verh. Bot. Ver. Brandenb. **65**: 88. 1923.

Parosela tehuacana Rydb., N. Amer. Fl. **24**: 113. 1920. — "Type collected at Tehuacan, Puebla, November 7, 1901, *Holway 53...*" — Holotypus, US! — *Dalea tehuacana* (Rydb.) Bullock, Kew Bull. **1939**: 199. 1939.

Specimens of var. *capitulata* collected at full anthesis suggest drought-inhibited var. *barbata* in which branchlets of the second and subsequent orders of ramification have failed to develop, so that the whole inflorescence is reduced to an interrupted spiciform raceme of small subsessile heads. Earlier in the year, however, before the primary cauline leaves have fallen, a foliose aspect of the same thing presents at least a few pedunculate heads terminal to main branchlets. At this stage var. *capitulata* is distinguished from var. *barbata* by its glabrescent or glabrate foliage and, more securely, by a shorter calyx-tube and substantially smaller keel-blades and androecium. The range of the two varieties is, moreover, significantly different.

Rydberg distinguished within the present var. *capitulata* two species, supposed to differ in number and size of leaflets. In Oaxaca the leaflets do tend to be relatively small and numerous (up to 11–15), whereas they tend to be larger and fewer (up to 7–9) in the Papaloapan drainage in Puebla. However one collection from the valley of Oaxaca (*Conzatti 5203*, NY) has leaves with 13 leaflets up to 8 mm long, that is of a size correct for *Parosela tehuacana* but of a number proper for *P. capitulata*. The material collected since Rydberg's revision provides a much fuller picture of these shrubby winter-flowering daleas than was accessible fifty years ago, and no longer suggests any noteworthy racial segregation. The var. *capitulata* was collected first by Karwinski (*nos. 5775, 5776,* M) in 1827.

139f. Dalea carthagenensis (Jacquin) Macbride var. isthmicola Barneby (Plate CXXVI)

Low, twiggy shrubs up to 6 dm tall, glabrous to the spikes, the young branchlets verruculose; *main cauline leaves* persistent into anthesis of spikes, 3.5–4.5 cm long, sessile, with ± 19–25 stiffly chartaceous, marginally subrevolute, oblong-elliptic leaflets 6.5–8 mm long; *spikes* appearing axillary to living leaves, in reality terminal to very short leafless axillary shoots, rather loosely ± 10–20-flowered, without petals ± 14–15 mm diam, the villosulous axis mostly 1–1.5 cm long; *bracts* elliptic, villosulous dorsally below middle, thence green, glabrate, charged with prominent blister-glands; *calyx* 6.5–7 mm long, villosulous all over with fine, spreading-ascending hairs up to 0.6–0.75 mm long, the tube ± 2.5 mm long, less densely and more shortly pubescent than the plumulose teeth, the intercostal glands ± 3–4, prominent but small, the recurving teeth up to 4–4.6 mm long, the dorsal one obscurely sigmoid distally; *petals* opening greenish-creamy fading brownish-maroon; *banner* ± 5.3 mm long, the claw 2.4–2.7 mm, the blade 3.1–3.2 mm long, 3.4–3.7 mm wide; *keel* 6.7 mm long, the claws 2.2 mm, the blades 5 mm long, 2.9 mm wide; *androecium* ± 7 mm long. — Collections: 1 (o).

Brushy savannah country below 225 m (750 ft), known only from the type-locality near Chivela Pass on the continental divide of Isthmus of Tehuantepec, s.-e. Oaxaca. — Flowering November–December.

Dalea carthagenensis (Jacqu.) Macbr. var. **isthmicola** Barneby, var. nov., var. *capitulatae* (Rydb.) Barneby proxima sed statura humili, caulibus verruculosis, foliolis foliorum caulinorum majorum pluri (9–12, nec 4–7)-jugis, spicis laxius plurifloris (axi 10–15 nec 2–7 mm longo), necnon floris paullo majoris carinae lamina majori (± 5 nec 3.7–4.4 mm longa) recedens. — OAXACA: between the railroad stations of Chivela and Nizanda on the trans-isthmus line, Isthmus of Tehuantepec, Dec 28, 1944, *E. J. Alexander 191.* — Holotypus, NY; isotypi, MEXU, MICH.

While reluctant to describe further varieties of *D. carthagenensis*, especially from only one collection, I feel obliged to provide a taxonomic niche for this distinct-looking plant. It appears to be most closely akin to var. *capitulata*, its relative nearest northward, which abounds in the arid valleys of central Oaxaca at elevations upward from 800 m. Features common to the two are the relatively small, firm leaflets, no doubt an adaptation to xeric habitat, and the reduction of the inflorescence to spikes sessile at the tip of very short axillary spurs along the branches of the current year. The var. *isthmicola* differs in its low stature, verruculose stems, numerous leaflets, and longer, looser spikes of rather larger flowers. The main cauline leaves of var. *capitulata* are commonly thrown off before the flowering spikes reach anthesis, but are persistent in var. *isthmicola*. Only the distantly allopatric var. *floridana* has as many pairs of leaflets; this is a taller plant, nearly always villosulous throughout, and has spikes central to each major division of the panicle elevated on a developed peduncle. The var. *barbata*, which represents the species in Central America from mountainous Chiapas southward, has flowers of the size of var. *isthmicola* but combined with leaflets at once fewer and larger, and in consequence a different aspect.

139g. DALEA CARTHAGENENSIS (Jacquin) Macbride var. BREVIS (Macbride) Barneby (Plate CXXVII)

Either glabrous to the spikes, or the young twigs puberulent, or the stems, leafstalk and -rachis, and lower face of leaflets thinly and loosely pilosulous; *primary cauline leaves* up to (1.5) 2–5.5 cm long, with 11–15 (17) leaflets up to (4) 5–15 mm long; *peduncles* terminal to main branches developed, up to 2.5 cm long, the later ones obsolete or nearly so, the whole inflorescence irregularly corymbose; *spikes* short and dense, the villosulous axis 3–11 mm long; *bracts* 2–4.5 mm long, gland-tuberculate dorsally, the lowest sometimes glabrous, the rest (or all) pilosulous; *calyx* 3.8–6.3 mm long, densely silky-pilose throughout, the tube 2–2.6 mm long, the intercostal glands small, 3–5, not conspicuous externally, the teeth triangular at base with a subulate or setiform tip, the whole 1.5–3.7 (4) mm long; *banner* ± 3.8 mm, the blade 2.4–2.8 mm long; *keel* 4.9–5.9 mm long, the claws 1.8–2.2 mm, the blades 3–4 (4.4) mm long, 1.7–2.6 mm wide; *androecium* 5.5–6.5 mm long. — Collections: 19 (o).

Dry hills and valley floors, in arid tropical brush or thorn-forest, 20–2000 m, locally abundant, Pacific slope and coast of s. Ecuador (Guayas, Azuay, Loja) and adjoining Peru (Piura, Tumbes), and upper Marañón valley in n. Peru (Cajamarca); apparently isolated (? native) in the upper Mantaro valley, at ± 2400 m. in Ayacucho, centr. Peru. — Flowering April to October, perhaps through the year. — *Representative*: ECUADOR. AZUAY: *Hirsh, s. n.* (NY). LOJA: *Espinosa 592* (IAN, NY, US); *Rose, Pachano & Rose 23,350* (NY, UC). GUAYAS: *A. S. Hitchcock 20,120* (NY, US). PERU. TUMBES: Tumbes: *Ferreyra 10,726* (US), *12,289* (REGINA). PIURA:

Tabara: *Haught 170* (F, NY, US). Huancabamba: typus of *D. microphylla*. Ayabaca: typus of *D. vicina*. CAJAMARCA: Jaén: typus of var. *brevis*; *Weberbauer 7119* (F, US). Celendín: *Ferreyra 15,060* (US). Chota: *Ferreyra 785* (US). AYACUCHO: Ayacucho: *Soukup 4043* (F, US).

Dalea carthagenensis (Jacqu.) Macbr. var. **brevis** (Macbr.) Barneby, comb. nov., based on *Parosela microphylla* var. *brevis* (short, of the calyx-teeth) Macbr., Field Mus., Bot. **4**: 103. 1927. — "PERU: between Shumba and Taen [= Jaén], Dept. of Cajamarca, April, 1912, *Weberbauer 6191...*" — Holotypus, F! = *Field Neg. 50204*, NY! isotypus, US! — *Dalea microphylla* var. *brevis* (Macbr.) Macbr., Field Mus., Bot. **13**: 370. 1943.

Dalea microphylla (small-leaved) H. B. K., Nov. Gen. & Sp. (folio) **6**: 482. 1823. — "Crescit locis montosis Peruviae, inter Loxam et San Felipe, prope Guancabambam, alt. 1028 hex." — Holotypus, labelled "Guancabamba", *Humboldt & Bonpland 3536* (P, herb. H. B. K.)! — *Parosela microphylla* (H. B. K.) Rose, Contrib. U. S. Nat. Herb. **10**: 106. 1906.

Parosela vicina (close, to the preceding) Macbr., Field Mus., Bot. **4**: 103. 1927. — "PERU: between Olleros and the valley of the Quiros, Province of Ayavaca, Dept. of Piura, May, 1912, *Weberbauer 6350...*" — Holotypus, F! = *Field Neg. 50209*, NY! isotypus, US! — *Dalea microphylla* var. *vicina* (Macbr.) Macbr., Field Mus., Bot. **13**: 370. 1943.

The var. *brevis* varies in amount and distribution of pubescence, the types of var. *brevis* itself and of *D. microphylla* having glabrous leaves, whereas those of the type of *P. vicina* are thinly pilosulous beneath. The hairy form occurs also in Ecuador, and there is no reason to suspect that it is ecologically or geographically separated from the glabrous ones. Variation in length of the calyx-teeth is more striking: the dorsal tooth varies from 0.8 mm shorter up to 1.7 mm longer than the tube. The material from the Pacific slope in Ecuador and neighboring Peru furnishes examples of a dorsal tooth 2, 2.3, 2.6, 3, 3.7 and 4 mm long, forming a random series, not to be sorted into a significant pattern of dispersal. It seems best, therefore, to treat *D. microphylla* and Macbride's two varieties of it as minor variants. It will be noted that the three proposals were based on collections from the same general area in Piura and northern Cajamarca. So far as I can see, the material of var. *brevis* from the Marañón valley does not differ significantly from that of the Pacific slope. The one collection from Ayacucho is also inseparable morphologically. If native there, it forms a link between var. *brevis* of northern Peru and var. *pilocarpa* on the east edge of the Andean plateau in Bolivia.

The var. *brevis* often closely resembles the Mexican var. *capitulata*, apparently differing chiefly in the organization of the inflorescence, which remains more or less corymbose even in the drought-inhibited, nearly leafless stage. The calyx-teeth of var. *brevis* are on the average both shorter and less densely plumose-ciliate. In habit var. *brevis* resembles also var. *pilocarpa*, which has fewer leaflets and ultimately looser flower-spikes; and the geographically nearer var. *trichocalyx*, discussed under the following.

139h. DALEA CARTHAGENENSIS (Jacquin) Macbride var. TRICHOCALYX (Ulbrich) Barneby

(Plate CXXVII)

Densely silky-pilosulous throughout, the longer hairs mostly up to 0.5–0.8 mm long, the young foliage canescent, the leaflets becoming greenish (but not glabrate) in age; *primary cauline leaves* up to 2–3.5 cm long, with 9–13 (15) leaflets up to 4.5–10 mm long; *peduncles* 0–2 cm long, present only low on the main divisions of the inflorescence; *spikes* short and dense, ovoid-subcapitate, without petals ± 10–12 mm diam,

the axis less than 1 cm long; *bracts* 2.5–5.5 mm long, pilosulous dorsally, densely ciliate; *calyx* 4.7–5.8 mm long, densely silky-pilosulous, the tube 2–2.4 mm long, the intercostal glands 1–3 in each interval, not or scarcely visible externally, the teeth (2.4) 2.7–3.4 mm long, the dorsal one 0.1–1.6 mm longer than tube; *banner* (3.7) 4–5 mm long, the blade (2) 2.2–3 mm long, 2.7–4 mm wide; *keel* (4) 5.4–6.3 mm long, the claws 1–2.2 mm, the blades (3.2) 3.4–4.5 mm long, 1.8–3 mm wide; *androecium* 5.2–7 mm long. — Collections: 7 (o).

Dry rocky hillsides and thinly brushy valleys on the Pacific slope of the Peruvian Andes, 970–2760 m, in scattered stations from La Libertad s. to Huancavelica. — Flowering March to June, perhaps at other seasons. — *Material*: LA LIBERTAD. Santiago de Chuco: *López Miranda 1087* (US). ANCASH: typus. LIMA. Huarochirí: *Weberbauer 5212* (F); *Goodspeed 33,103* (UC, US); *Ferreyra 7040* (US). Cañete: *Hirsh s. n.* (NY). HUANCAVELICA. Castrovirreyna: *Angulo 3089* (US).

Dalea carthagenensis (Jacqu.) Macbr. var. **trichocalyx** (Ulbr.) Barneby, stat. nov., based on *D. trichocalyx* (with hairy calyx) Ulbr., Feddes Repert. **2**: 7. 1906. — "PERUVIA: Departimentum Ancachs prope Caraz [= Huaraz], 2200–2500 m. s. m. (A. Weberbauer no. 2994 leg. maio 1903...)." — Holotypus, formerly B, survives as *Field Neg. 737*, F + fragm. clastotyp., NY, US! — *Parosela trichocalyx* (Ulbr.) Macbr., Field Mus., Bot. **4**: 102. 1927.

Macbride has already twice pointed out that *D. trichocalyx* is not distinguishable by any character of moment from the *D. carthagenensis* alliance. It is evidently very close to the preceding var. *brevis*, one variant of which has thinly villosulous but not densely gray-silky foliage, and would be reducible to it, except for its disjunct range. In general appearance var. *trichocalyx* much resembles some forms of the Central American and Colombian var. *barbata*, but has a slightly smaller calyx, shorter keel-petals, and correspondingly shorter androecium. The fresh petals are described as yellow turning dull red-purple.

139i. DALEA CARTHAGENENSIS (Jacquin) Macbride var. PILOCARPA (Rusby) Barneby (Plate CXXVII)

Very close to the glabrous phases of var. *carthagenensis*; *leaflets* of the drought-deciduous primary leaves little known, apparently 7–9 (11), relatively small, 3–6 mm long; *spikes* in early anthesis subcapitate, ± elongating, the densely villosulous axis becoming 7–25 mm long; *bracts* 3.7–6.5 mm long; *calyx* 5.8–6.5 mm long, the tube 2.2–2.5 mm, the intercostal glands relatively large, prominent, livid, the dorsal tooth 3.3–4.3 mm long; *keel* 5.4–6 mm long, the claws 1.8–2.3 mm, the blades 3.7–4 mm long, 2–2.4 mm wide; *androecium* 5.8–6.5 mm long. — Collections: 4 (o).

Arid rocky or brushy hillsides, river-terraces, and washes, seeding (or carried) down into sandy river-beds, 750–2600 m, known only from the e. slope of Cordillera Real in Dept. La Paz, Bolivia. — Flowering April to July.

Dalea carthagenensis (Jacqu.) Macbr. var. **pilocarpa** (Rusby) Barneby stat. nov., based on *D. pilocarpa* (with hairy pod) Rusby, Mem. N. Y. Bot. Gard. **7**: 261. 1927. — "Espia, 3500 feet, *O. E. White,* July 25, 1961 (*no. 609*). — *Material*: LA PAZ. Larecaja: Sorata, near San Pedro, *Mandon 701* (F, MICH, NY, US, W). Sud Yungas: Espia, typus; *Cárdenas 4361* (US). Near Calisaya on Río Bopi, *Krukoff 10,038* (F, NY, US).

Hardly distinct from var. *carthagenensis*, but the keel-petals slightly smaller and the leaflets of primary leaves slightly fewer. It is less like var. *brevis*, which extends south in

Peru to Ayacucho, but may be derived from that source, for genuine var. *carthagenensis* is essentially Caribbean, not known from the southern hemisphere. The small known range of var. *pilocarpa* lies 600–700 km to the southeast of the southern limits of var. *brevis* and var. *trichocalyx* in Ayacucho and Huancavelica in Peru.

140. DALEA TENUICAULIS Hooker fil.

(Plate CXXVIII)

Shrubs up to 2 m tall, glabrous to the inflorescence, the old stems becoming stramineous, furrowed, the young ones pale or purplish, densely and prominently verruculose, the primary cauline leaves subtending many slender, drought-inhibited, often clavately thickened and densely leafy short-shoots, the foliage glaucescent, ordinarily thick-textured, the mostly folded, or in some primary leaves expanded and flatter leaflets smooth above, densely gland-dotted beneath; *leaf-spurs* up to 0.7 mm long; *stipules* narrowly triangular-subulate, sometimes minutely ciliolate, 0.4–1.4 mm long; *intrapetiolular glands* 2, subimpressed, tiny; *post-petiolular glands* small but prominent, acute, golden; *leaves* strongly dimorphic, the primary cauline ones appearing after rains, usually deciduous by anthesis, up to 1.5–2.5 cm long, short-petioled, with narrowly green-margined petiole and 7–9 pairs of obovate-cuneate to oblong-obovate, emarginate, mostly folded and backwardly arched leaflets 2.5–5 (8) mm long, the terminal one usually longest, either stalked or forming an exact trefoil, the leaves of short-shoots much shorter, with only 3–6 pairs of leaflets often only 1–2 mm long; *spikes* of two sorts, a few pedunculate and leaf-opposed, borne on the long twigs, the peduncle up to 2.5 cm long, followed by many terminal to axillary spurs, all shortly ovoid or subglobose, without petals 9–10 mm diam, the villosulous axis 2–12 (15) mm long; *bracts* deciduous, ovate short-acuminate, 2–4 mm long, 1.6–2.2 mm wide, shallowly navicular, firm, herbaceous becoming brownish, all verruculose and usually also villosulous dorsally, the lowest sometimes glabrate, all glabrous within; *calyx* 4.7–5.3 mm long, densely villosulous with fine spreading hairs up to 0.7–1.1 mm long, the tube 2–2.2 mm long, slightly oblique at orifice, the ribs slender becoming prominent, the membranous intervals charged with 3–5 externally prominent, lens- or nipple-shaped, golden or ruby-colored glands, the lanceolate to ovate-acuminate, gland-spurred teeth all straight, the dorsal one longest and narrowest, 2.6–3 mm long (0.4–1 mm longer than tube); *petals* opening yellowish or greenish, soon suffused with pink or dull purple, all charged near apex with a long elliptic blister-gland, the epistemonous ones perched low on androecium (± 1–1.7 mm above hypanthium); *banner* 4.2–5 mm long, the claw 2–2.3 mm, the deltate-ovate, hooded blade recessed at base into a shallow cornet, 2.8–3.3 mm long, 3–3.4 mm wide; *wings* 4.1–5.2 mm long, the claw 1.8–2 mm, the obliquely ovate blade 3–3.6 mm long, 1.7–2 mm wide; *keel* 5.7–6.3 mm long, the claws 2.4–2.7 mm, the obliquely ovate blade strongly convex on lower side, 3.3–3.8 mm long, 2–2.2 mm wide; *androecium* 6.6–7.1 mm long, the longer filaments free for 1.6–2 mm, the connective gland-tipped, the anthers 0.55–0.65 mm long, the alternate ones sometimes much smaller. — Collections: 10 (o).

Cinder slopes, malpais, sometimes in drought-deciduous thickets, endemic to Islas Galápagos (Isabela, San Salvador, Santa Cruz, San Cristóbal, and Santa María). — Leafless following drought, amply leafy after rains and flowering when primary leaves are already falling.

Dalea tenuicaulis (thin-stemmed) Hook. f., Trans. Linn. Soc. **20**: 226. 1825. — "Hab. Albemarle Island, *Charles Darwin, Esq.*" — Holotypus, collected on Albemarle (Isabela) I., but by *Macrae*, K (herb. Hook.)! — *Parosela tenuicaulis* (Hook. f.) Macbr., Contrib. Gray Herb., New Ser. **65**: 23. 1922.

Dalea parvifolia (small-leaved) Hook. f., Trans. Linn. Soc. **20**: 225. 1825. — "hab. James Island, *Charles Darwin, Esq.*" — Holotypus, examined by Rudd but not by the author, CGE; isotypi, labelled "Chatham I., end of September 1835, *C. Darwin*", K (herb. Hook., herb. Benth.)! — *Parosela parvifolia* (Hook.) Macbr., Contrib. Gray Herb, New Ser. **65**: 23. 1922.

Dalea tenuicaulis var. *goniocymbe* (with angled keel) Riley, Kew Bull. **1925**: 221. 1925. — "Charles Island; 60 m., fl. July, *Hicks in Riley 420...*" — Holotypus, collected jul 31, 1924, by J. B. Hicks, K!

The comprehensive concept of *D. tenuicaulis* as the one, somewhat polymorphic dalea native to the Galápagos, recently formulated by Rudd (in Wiggins, Fl. Galap. 613, 614, fig. 165 + map. 1971) is readily acceptable. The seasonal dimorphism characteristic of ser. *Thyrsiflorae* is accentuated under the severe conditions of the archipelago and seems to account for all apparent diversity in the material seen. Following a period of drought the small, awkwardly branching shrubs are bare of leaves, each twig knobbed with axillary short-shoots clad in the remains of castaneous or blackish stipules. A phase of short duration following rains is amply leafy, the leaflets sometimes attaining a length of 8 mm and the primary leaf-rachis up to 2 cm long, but bears few flowers, these if present arranged in terminal and sometimes pedunculate heads. As the primary foliage drops off, a new set of axillary short-shoots develops, each forming a little cluster of smaller leaves with tiny, thick-textured leaflets, many of them going out into a short headlike spike of silky calyces. Because *D. tenuicaulis* is the only *Dalea* known from Galápagos archipelago and all known material was so recently revised by Rudd (in Wiggins, 1971, and personal correspondence), I have cited no specimens other than types. My description is based on material at CAS, GH, K, NY, US.

The direct relationship of *D. tenuicaulis* seems to lie with *D. carthagenensis*, in particular with those forms of the variable var. *brevis* found on the coastal deserts of Ecuador and northern Peru. These differ in the longer leaves, less crowded leaflets, and more openly branching panicle of spikes, that is in relatively plastic features of habit rather than in any modification of the flower.

141. DALEA SCANDENS (Miller) R. T. Clausen
(Plate CXXIX)

Essentially like *D. carthagenensis*, up to 15 dm tall, ordinarily villosulous throughout, exceptionally glabrous to the inflorescence, the leaflets bicolored, green above, pallid or subglaucescent beneath; *leaves* dimorphic, the primary cauline ones 2–5 (7) cm long, with 7–17 leaflets (4) 5–18 (22) mm long; *peduncles* usually very short or 0, the first of each major division of the panicle sometimes developed and up to 2.5 cm long; *spikes* moderately loose, ovate-oblong to capitate-subglobose, the flowers falling into 2–3 ranks when pressed, the axis becoming 2–20 (30) mm long; *bracts* broadly lance- or ovate-acuminate, 2–6.5 mm long, gross-glandular and usually villosulous dorsally; *calyx* (3.6) 4.2–8.9 mm long, the tube either glabrous or villous, (1.6) 1.8–2.8 (3.1) mm long, the brown ribs prominent, the intervals charged with 1 row of (2) 3–6 discrete or (by confluence) 1–2 larger, orange-brown blister-glands, the tri-

angular-aristiform, gland-spurred teeth ± unequal, plumose-plumulose with spreading hairs up to 0.6–1.1 mm long, the dorsal tooth sigmoidally arched in age, uncinate at apex, (1.6) 2.4–6.2 mm long; *petals* as in *D. carthagenensis*; *banner* 4.3–8.5 mm long; *pod* of *D. carthagenensis.*

As mentioned in the discussion of ser. *Thyrsiflorae, D. scandens* is set off only precariously from *D. carthagenensis* by its strongly hooked calyx-teeth. The Mexican and Caribbean phases of the two species are vicariant in range, and fulfil the conditions expected of mutually exclusive geographic subspecies; but in Central America, from Chiapas into Nicaragua, each of the major species is represented by a variety, these sympatric and very readily separable.

Key to the Varieties of *Dalea scandens*

1. Foliage villosulous; widespread.
   2. Calyx-tube (1.6) 1.8–2.4 (2.5) mm long, ordinarily glabrous or much less thickly pubescent than the plumulose teeth (rarely villosulous in Yucatán and Oaxaca); *glands* in intervals of calyx-tube mostly 1–3, large and conspicuous, often confluent; extreme s. Texas, Caribbean slope in Mexico, w. Cuba, s. to Nicaragua.
      3. Leaflets of primary cauline leaves 7–11; *keel-blades* 2.5–3.5 (3.7) mm long; *androecium* mostly 4.3–5.5 mm long; s. Texas to Oaxaca, rarely to Chiapas, Yucatán peninsula, and w. Cuba, essentially Caribbean. 141a. var. *paucifolia.*
      3. Leaflets of primary leaves 11–17 (fewer on leaves of short-shoots); *keel-blades* (3.1) 3.5–5.5 mm long; *androecium* 5.5–8.5 mm long; Guatemala to Nicaragua. 141b. var. *vulneraria.*
   2. Calyx-tube 2.4–2.8 mm long, villosulous like the teeth; *glands* in intervals of calyx mostly 3–6, small and discrete; *leaflets* of primary leaves 7–11 (13), but androecium 5.8–7 mm long; Pacific coast of Mexico, from s. Sonora to Jalisco. 141c. var. *occidentalis.*
1. Foliage glabrous or almost so; rare (poorly understood) forms of Veracruz, Campeche, and Yucatán peninsula, sympatric with var. *paucifolia* and doubtfully distinct.
   4. Calyx-tube and axis of spike at least thinly pubescent; *dorsal calyx-tooth* 4–5 mm long, much longer than tube; *keel-blades* ± 4.5 mm long; Veracruz. 141d. var. *scandens.*
   4. Calyx-tube and axis of spike glabrous (only the teeth ciliate); *dorsal* tooth 1.6–2.1 mm long, ± equalling tube; *keel-blades* ± 3 mm long; Yucatán and Quintana Roo. 141e. var. *gaumeri.*

141a. DALEA SCANDENS (Miller) R. T. Clausen var. PAUCIFOLIA (Coulter) Barneby

(Plate CXXIX)

Foliage always villosulous; *primary leaves* 2–4.5 cm long, the 7–11 leaflets (4) 5–13 (16) mm long; *spikes* mostly sessile or almost so, often drooping at tip, (2) 5–15 (20)-flowered, the axis (1) 2–20 (30) mm long; *calyx* 4.2–6 mm long, the tube ordinarily glabrous or less villosulous than the teeth, the glands in each interval mostly

2–3, prominent externally, the dorsal tooth 2.4–4 mm long; *androecium* 4.3–5.5 mm long; 2n = 14 (Mosquin). — Collections: 66 (v).

Thickets and thinly wooded or brushy hills of the Gulf Coastal Plain and adjoining piedmont of Sierra Madre Oriental from s. Texas (Nueces, Starr, Cameron cos.) to Veracruz and Yucatán Peninsula, Mexico, e. to w. Cuba, s., apparently uncommonly, into the highlands of Chiapas, there reaching 1600 m and passing into var. *vulneraria*. — Flowering intermittently through the year, but mostly from September to April, the leafy forms prevalent in fall, the drought-depleted forms in the winter months. — *Representative*: UNITED STATES. TEXAS: *F. B. Jones 3575* (TEX); *Rose & Russell 24,191* (NY); *Correll 35,549* (OKLA). MEXICO. TAMAULIPAS: *Palmer 119* (F, NY); *Gentry 6756* (ARIZ, UC). *Ripley & Barneby 14,752* (CAS, DAO, MEXU, NY). NUEVO LEÓN: *Ripley & Barneby 13,560* (CAS, NY), *13,551* (CAS, MEXU, NY, US). SAN LUIS POTOSÍ: *Palmer 239* (F, NY); *Pringle 2415* (BR, F, GH, MEXU, SD, W); *Rzedowski 6846* (ENCB). VERACRUZ: *Sousa 1862* (MEXU); *Conzatti 851* (GH); *Purpus 2346* (UC, Z), *16,189* (C), *12,006* (F, UC). YUCATÁN: *Gaumer 1728* (F, NY, W), *24,048* (F, NY), *23,221* (F, NY). OAXACA: *Mell, s.n.* (NY). CHIAPAS: *Breedlove & Raven 8344* (US); *Miranda 7458* (MEXU). CUBA. HABANA: *Van Hermann 2579* (NY, UC); *Baker 1883* (NY); *Ekman 13,198* (NY).

Dalea scandens (Mill.) R. T. Clausen var. **paucifolia** (Coult.) Barneby, comb. nov., based on *D. domingensis* var. *paucifolia* (with few leaflets) Coult., Contrib. U. S. Nat. Herb. **1**: 34. 1890. — "Rio Grande City (Starr County)...Texas." — Holotypus, *Nealley 144 in 1889*, US! isotypus, NY!

Psoralea humilis (lowly) Mill., Gard. Dict., ed. 8, *Psoralea* No. 7. 1768 ("*Humilus*"). — Holotypus, labelled "*Barba Jovis Americana, humilis, etc.* e Vera Cruce, 1730, Houston", BM! — Non *Dalea humilis* G. Don, 1832. — *Parosela humilis* (Mill.) Rydb., N. Amer. Fl. **24**: 114. 1920.

Dalea thyrsiflora (with flower-spikes in thyrselike panicles) Gray, Proc. Amer. Acad. **5**: 177. 1861. — "Monterey and San Fernando, in the northern part of Mexico, and farther south from Victoria to Tula, coll. Berlandier, no. 763, 846, 1386, 2183, 2266." — Lectotypus, *Berlandier 846 = 2266*, GH! isotypus, NY! paratypi, as given by Gray, GH!. *Parosela thyrsiflora* (Gray) Vail, Bull. Torrey Club **24**: 14. 1897. — *Dalea emphysodes* subsp. *thyrsiflora* (Gray) R. T. Clausen, Bull. Torrey Club **73**: 85. 1946. *D. carthagenensis* subsp. *thyrsiflora* (Gray) R. T. Clausen, Bull. Torrey Club **73**: 572. 1946.

Around the Gulf from Corpus Christi, Texas, into Veracruz the calyx-tube of var. *pauciflora* is commonly glabrous, but not consistently so; in Yucatán and Cuba it is thinly pilose. In Tamaulipas and Nuevo León the spikes are often curved over at tip, appearing wilted, but apparently not so elsewhere. On the Gulf Coast Plain in northeastern Mexico the species is extremely common and locally abundant, especially in wasteland around villages, in disturbed savanna, and second-growth brush, forming in places an almost continuous undergrowth. The variety was first collected by Houston at Veracruz in 1730 and again about 50 years later somewhere in Mexico by Sessé & Mociño (*Herb. S. & M. 2672*, F).

141b. DALEA SCANDENS (Miller) R. T. Clausen var. VULNERARIA (Oersted) Barneby

(Plate CXXIX)

Foliage always villosulous; *primary leaves* 2.5–6 cm long, with 11–17 leaflets (4) 6–14 (17) mm long; *spikes* mostly sessile or almost so, the peduncle exceptionally

up to 1.5 cm long, the axis 2–10 mm long; *calyx* (4) 4.3–6.5 mm long, the glabrous tube 1.8–2.5 mm long, the glands in each interval large, up to 3 but mostly confluent into 1 or 2, the teeth plumulose with hairs 0.4–11 mm long, the dorsal one (2) 2.4–4 mm long; *keel* (4.6) 5.2–7.9 mm, its blades (3.1) 3.5–5.5 mm long; *androecium* 5.5–8.5 mm long. — Collections: 67 (o).

Brushy hillsides, margins of fallow fields, hedges, and as an understorey growth of thorn-forest, ascending into the lower oak-pine belt, 600–1800 m, locally abundant and common in the highlands of s. Guatemala, El Salvador, adjoining Honduras, and Nicaragua, toward the Mexican boundary not clearly distinguished from var. *paucifolia*. — Flowering November to March. — *Representative*: GUATEMALA. PETÉN: *M. Aguilar 388* (F, NY). CHIMALTENANGO: *Standley 64,491* (F, NY). SACATEPÉQUEZ: *Standley 59,955* (F, NY). GUATEMALA: *Kellermann 6575* (F, UC). AMATITLÁN: *Kellermann 6377* (F, US). SANTA ROSA: *Heyde & Lux 4131* (F, M, NY, US). JUTIAPA: *Steyermark 31,976* (F). ZACAPA: *Steyermark 43,140* (F). JALAPA: *Standley 76,695* (F, NY). CHIQUIMULA: *Steyermark 30,356* (F). EL SALVADOR. SANTA ANA: *Standley & Padilla 3283* (F). SAN SALVADOR: *Standley 19,201, 20,507* (NY). HONDURAS. COPÁN: *Molina 6590* (F). OCOTEPEQUE: *Standley 27,967* (F). INTIBUCÁ: *Standley 25,244* (F). COMAYAGUA: *Standley 55,824, 56,038* (F). MORAZÁN: *Standley & Molina 4315* (F); *Williams & Molina 14,839* (F). OLANCHO: *Standley 18,297* (F). EL PARAÍSO: *Rodríguez 1976* (F); *Molina 7590* (F). CHOLUTECA: *Standley 15,707*. NICARAGUA. ESTELÍ: *Williams & Molina 20,158* (NY). JINOTEGA: *Standley 9515, 9875, 10,394* (F).

Dalea scandens (Mill.) R. T. Clausen var. **vulneraria** (Oerst.) Barneby, stat. nov., based on *D. vulneraria* (healing) *β typica* Oerst., Vidensk. Meddel. **1853**: 4. 1854. — "...i Provindsen Segovias Höiland imellem Matagalpa og Chinotega i en Höide af 3–4000 Fod...[Nicaragua]." — Holotypus, labelled "N. 4. *Dalea sp. nov.* Ad. Ginotega in Segovia" and "*Dalea vulneraria β* typica. Ad Matagalpam in Segovia", these tickets accompanied by a modern label identifying the plant as *Liebmann 4596, p. p.*, C! isotypus, "*Oersted 4*", K! — *Parosela vulneraria* (Oerst.) Rydb., N. Amer. Fl. **24**: 115. 1920.

This is little more than a southern extension of var. *paucifolia*, but differs in its slightly more numerous leaflets and bigger flowers. The two entities were distinguished (but ill-defined) by Rydberg as *Parosela vulneraria* and *P. humilis* respectively, and were united by Clausen (1946) as *A. carthagenensis* subsp. *thyrsiflora*. The latter treatment is taxonomically defensible, but I have had little trouble in separating two series except in Chiapas and northern Guatemala, where intermediate forms are not infrequent. In practice this Central American dalea is easily recognized by the hooked calyx-teeth surmounting a glabrous tube decorated with exceptionally large and lustrous blister-glands. The sympatric, habitally similar *D. carthagenensis* var. *barbata* has straight teeth and a pilosulous tube charged with much smaller glands scarcely or not visible externally.

141c. DALEA SCANDENS (Miller) R. T. Clausen var. OCCIDENTALIS (Rydberg) Barneby

(Plate CXXIX)

Habit of var. *paucifolia*, the foliage always villosulous; *primary leaves* 2.5–5.5 (7) cm long, usually present only during fall months, with 7–11 (13) leaflets 8–18 (22) mm long, the leaves of short-shoots present January–April shorter, with only 5–9 smaller leaflets; *peduncles* mostly less than 3 mm long, a few of the earliest up to 1.5–2.5 cm; *spikes* 5–20 (25)-flowered, the axis 3–20 (30) mm long; *bracts* 3–5

(6.5) mm long; *calyx* (5.6) 6–8.9 mm long, villosulous from base, the tube 2.4–2.8 mm, the glands in each interval (2) 3–5 (6), mostly small, discrete, the dorsal tooth (3.2) 3.4–6.2 mm long; *keel* 5–6.3 mm, the claws 1.4–2.3 mm, the blades 3.3–4.2 mm long, 1.7–2.3 mm wide; *androecium* 5.8–7 mm long. — Collections: 21 (o).

Arid hillsides and thickets in thorn-forest, near sea-level up to 600 m (± 2000 ft), coastal plain and foothills along the w. coast of Mexico from s. Sonora to s. Sinaloa, apparently disjunctly in s.-w. Jalisco (but to be expected in intervening Nayarit). — Flowering October to April. — *Representative*: SONORA. Alamos: *Gentry 2938* (ARIZ, UC, US); *Ripley 14,244* (ARIZ, CAS, F, NY, UC). SINALOA. El Fuerte: *Rose, Standley & Russell 13,619* (NY, US). Mocorito: *Gentry 5732* (ARIZ, NY). Culiacán: typus. Mazatlán: *Rose, Standley & Russell 13,695, 14,024* (NY, US); *Ortega 6781* (BR, US). San Ignacio: *Ortega 33* (MEXU); *Gentry 5713* (ARIZ). Concordia: *Ortega 6321* (M). JALISCO. La Huerta: *McVaugh 23,043* (ENCB, MICH); Tomatlán: *McVaugh 25277* (MICH).

Dalea scandens (Mill.) R. T. Clausen var. **occidentalis** (Rydb.) Barneby, stat. nov., based on *Parosela occidentalis* (western) Rydb., N. Amer. Fl. **24**: 115. 1920. — "Type collected at Culiacan, Sinaloa, October 25 to November 18, 1891, *Edward Palmer 1783...*" — Holotypus, NY! isotypi, some labelled "Lodiego, Oct. 9–15", ARIZ, UC, US! — *Dalea occidentalis* ((Rydb.) Riley, Kew Bull. **1923**: 337. 1923; Wiggins, Contrib. Dudl. Herb. **3**: 53. 1940.

Parosela platyphylla (with flat leaflets) Rydb., N. Amer. Fl. **24**: 115. 1920. — "Type collected on dry hills in the vicinity of Fuerte, Sinaloa, March 26, 1910, *Rose, Standley & Russell 13527...*" — Holotypus, US! isotypus, NY!·

Dalea blasiana (of San Blas) Jones, Contrib. West. Bot. **15**: 138. 1929. — "No. 23040. San Blas Sinaloa, February 1, 1927." — Lectotypus (Morton, Contrib. U. S. Nat. Herb. **29**: 102. 1945), UC (lacking at POM)! isotypi, GH, NY, UC, US!

The var. *occidentalis* is weakly distinguished from var. *paucifolia* by a deeper calyx-tube charged with more numerous and smaller intercostal glands; on the average the petals are a little more ample and the calyx-teeth a trifle longer. In other respects the varieties are in close accord. As in var. *paucifolia*, the spikes may be either erect or (cf. *Rose, Standley & Russell 14,724*; *Gentry 5732*) nodding. The distantly allopatric var. *vulneraria* differs from var. *occidentalis* in the calycine characters just mentioned, and has furthermore slightly more numerous leaflets.

The evaluation of *Parosela occidentalis* and *P. platyphylla* as trivial variants of one entity (Wiggins, 1940, p. 53) is unquestionably correct. The typus of the former was collected at the end of the rainy season and presents a foliose condition with many relatively long primary leaves with up to six pairs of leaflets, whereas that of *P. platyphylla* was collected in late March after the primary leaves had fallen and only shorter rameal leaves with 2–4 pairs of leaflets persisted on the plant. Together they document the ordinary seasonal sequence in their species as a whole.

141d. DALEA SCANDENS (Miller) R. T. Clausen var. SCANDENS
(Plate CXXIX)

Slender, the ultimate branchlets flexuous but not twining, glabrous up to the inflorescence; *primary cauline leaves* up to 3.5 cm long, with 7–13 leaflets up to 1.4 cm long; *spikes* mostly sessile, only a few early ones pedunculate (peduncle to 2.5 cm), mostly few-flowered, subcapitate, the villosulous axis becoming 2–9 mm long; *bracts* 2.5–4.5 mm long, glabrate dorsally, ciliolate; *calyx-tube* thinly pilosulous to almost

glabrous, up to 2.3 mm long, the intercostal glands 2–3, distinct, the plumulose teeth unequal, the dorsal one longest, up to 4–5 mm long; *androecium* up to 6.5 mm long. — Collections: 10 (o).

Thickets and brushy slopes, near the coast and up to 1800 m in the foothills, sometimes in oak-forest, apparently local, known only from s. Veracruz and Campeche, Mexico. — Flowering in late fall and winter. — *Material*: VERACRUZ. Huatusco: *von Rozynski 793* (F). Fortín: *Kerber 300* (F). Dos Rios: Estancuela, *Ventura 2833* (NY). Axocuapan: *Purpus 2346* (F, p. p., MEXU, NY), *16,188* (C), *16,228* (C), *16,309* (F). Veracruz: *Paray 2877* (ENCB). ——: *Purpus 14,230* (F, UC); *Liebmann 4617* (UC). CAMPECHE: typus.

Dalea scandens (Mill.) R. T. Clausen, Bull. Torrey Club **73**: 83. 1946, based on *Psoralea scandens* (climbing, inapposite) Mill., Gard. Dict., ed. 8, *Psoralea* No. 4. 1768. — "...discovered by the late Dr. Houston at Campeachy..." — Holotypus, labelled "*Barba-Jovis americana scandens floribus coeruleis ad alas foliorum conglobatis*, Houston Mss.", BM! = *Bailey Hort. Neg. 5156*, NY! — *Parosela scandens* (Mill.) Rydb., N. Amer. Fl. **24**: 114. 1920.

Rydberg separated *D. scandens* from other glabrous *Thyrsiflorae* because of its few (mostly 3–4 pairs) leaflets. It was excluded by Clausen (1946) from his comprehensive *D. carthagenensis* because of a supposedly climbing habit of growth and blue petals. These characters are taken entirely from Houston's notes published by Miller, and are not borne out by the type-collection or by material gathered since in Veracruz. Rydberg rejected them, at least implicitly, describing *Parosela scandens* as a shrub, with yellow flowers purple in age. The ultimate branchlets of *D. scandens* are, it is true, very slender and flexuous, but there is no suggestion of a real twining habit. The color blue is unknown elsewhere in this group of daleas. Far from representing a discrete species, *D. scandens* is very doubtfully distinct from the plant described above as *D. scandens* var. *paucifolia*. Purpus collected both at Zacuapan, and it is possible that var. *scandens* is no more than a glabrate phase of the other; its keel-petals are, however, a little larger than in sympatric var. *paucifolia* and I therefore retain them provisionally as distinct, pending much-needed study in the field.

141e. DALEA SCANDENS (Miller) R. T. Clausen var. GAUMERI (Standley) Barneby (Plate CXXIX)

Glabrous except for ciliolate calyx-teeth; *primary leaves* 2–3 cm long, with 7–9 leaflets up to 7–9 mm long; *spikes* both sessile and short-pedunculate, the glabrous axis 0.5–2 cm long; *calyx* 3.6–3.8 mm long, the firm lustrous castaneous tube 2.8–3.1 mm long, the intervals charged with 3–4 (5) prominent livid glands, the dorsal tooth 1.6–2.1 mm long; *petals* rather tardily rubescent; *keel* 4–4.7 mm, the blades 2.8–3.1 mm wide. — Collections: 3 (o).

Habitat not recorded, to be expected in brush on limestone, known only from the three original stations in Yucatán and adjoining Quintana Roo, Mexico. — Flowering in winter. — *Material*: YUCATÁN. Tizimín: Pocoboch, *Gaumer 2408* (C, F, GH, NY, US). ——: San Anselmo, *Gaumer 1727* (BR, F, GH, UC, US, W). QUINTANA ROO: typus.

Dalea scandens (Mill.) R. T. Clausen var. **gaumeri** (Standl.) Barneby, stat. nov., based on *Parosela gaumeri* (George Franklin Gaumer, 1850–1929) Standl., Field Mus., Bot. **8**: 14. 1930. — "Yucatan: Chichankanab, *G. F. Gaumer 1457*..." — Holotypus, F; isotypi, GH, US!

This poorly documented variety greatly resembles and is probably not taxonomically separable from var. *scandens*, although easily recognized (as we know it) by the glabrous raceme-axis and short calyx-teeth. Like var. *scandens* it occurs within the range of the villosulous, usually long-toothed var. *paucifolia*, and may well consist of an artificial selection of minor variants. Field observation is required to determine the status of both.

IVC (xxvi). Series BRACHYSTACHYAE Barneby

Slender herbs, monocarpic or rarely biennial, glabrous to the subcapitate, plumose-pilose spikes of small flowers; *leaflets* 2–5 pairs; *spikes* mostly leaf-opposed, except in depauperate plants; *calyx-tube* subsymmetrical at orifice, its intercostal panels charged with a few small glands in 1 vertical rank, nearly always shorter than the triangular-aristate, finally stellate-spreading teeth; *petals* yellow, fading pinkish-brown to dull brownish-purple, the epistemonous ones perched low on androecium, the detached keel a little longer than banner, its blades ± 2–3 (4) mm long. — Sp. 1, of desert and high arid grassland, widespread (especially on calcareous strata) over the Mexican Plateau and Chihuahuan Desert, s. interruptedly to s. Puebla, n. and n.-w. to trans-Pecos Texas, centr. New Mexico, s.-e. Arizona, and adjoining Sonora.

Dalea subgen. **Parosela** sect. **Parosela** ser. **Brachystachyae** Barneby, ser. nov., radice annua rarius bienni, foliolis glaberrimis 2–5-jugis, calyce plumoso-piloso longidentato, petalisque concoloribus luteis demum rubescentibus vel brunnescentibus notabiles. — Sp. unica: **D. brachystachya** Gray.

The ser. *Brachystachyae* emphasizes the taxonomic isolation of its one species, the only monocarpic dalea with yellow petals. The detached flower, especially as the pod ripens and the calyx-teeth diverge into a five-rayed pappus, resembles that of the shrubby *D. zimapanica*, but the habit and leaves are of course different. A hypothetical plant with all features of *D. brachystachya* but purple or bicolored petals ordinary in subgen. *Parosela* would be sought in or near ser. *Reclinatae*, but the aspect of the leaf-spurs and foliage is so dissimilar that immediate kinship in this direction seems hardly possible. Rydberg placed the species in the heterogeneous group *Alopecuroides*, which accomodated monocarpic derivatives of the two subgeneric lines, genuine *Dalea* and *Parosela*. In this setting *D. brachystachya* is naturally associated with the also highly modified *D. filiformis*, another monotype described next below.

The range of *D. brachystachya* coincides rather neatly with that of the also yellow-flowered sect. *Cylipogon*; all of these are quickly distinguished by their more or less pilose stems and foliage, perennial roots, and double-crested pods.

142. DALEA BRACHYSTACHYA Gray
(Plate CXXX)

Low, slender or subfiliform herbs, commonly monocarpic, always flowering early the first year of growth and sometimes enduring into a second season, the root then lignescent but not over 3 mm diam, except for minutely ciliolate stipules glabrous to the spikes, with (1) 3–many, diffuse or both diffuse and assurgent, smooth or sparsely verruculose, pallid or purplish, simple or sparingly branched stems (0.5) 1–3.5 (4) dm long, thinly leafy and usually fertile from near middle upward, sometimes throughout or only terminally, the peduncles mostly leaf-opposed (but terminal to some ultimate branchlets and to primary stems when depauperate), the foliage pale

green or commonly glaucescent, the leaflets smooth and yellowish above, often red-edged, paler and livid-punctate beneath; *leaf-spurs* almost 0; *stipules* subulate, narrowly triangular or subulate-attentuate, 0.8–2.5 mm long, becoming brown and fragile; *intrapetiolular glands* 0 or minute; *post-petiolular glands* small, sometimes prominulous, golden or livid; *leaves* short-petiolate, 8–25 (30) mm long, with narrowly margined, sparsely verruculose rachis and (1) 2–5 pairs of oblanceolate to linear-oblanceolate, emarginate, usually loosely folded leaflets 2–14 (16) mm long, the terminal one nearly always longer than the last pair, either sessile with them or shortly stalked and solitary; *peduncles* very slender or subfiliform, 1–7 cm long (rarely subobsolete), longer than the opposed leaf, often arched outward from the stem and abruptly incurved under the spike; *spikes* conic-ovoid becoming ovoid, globose, or shortly oblong, without petals 8–11 (12) mm diam, the hispidulous axis ultimately 3–16 mm long; *bracts* rather tardily deciduous, rhombic-ovate- to lance-acuminate or -caudate, 2.5–6 mm long, the lowest glabrous dorsally but ciliate below middle, the upper ones often thinly pilose dorsally, plumose-ciliate, all prominently glandular dorsally, commonly livid-purplish, glabrous within; *calyx* (3.5) 4.4–5.8 (6) mm long, densely pilose with straight spiral, at first forwardly subappressed, soon spreading hairs up to 0.7–1.4 (1.7) mm long, the tube (1.5) 1.6–2.1 mm, not recessed behind banner, the ribs brownish, prominulous, the membranous intervals charged with 1 row of ± 3 small, yellow or transparent, sometimes obsolete glands, the teeth triangular-aristate, gland-tipped and -spurred, at first erect, finally stellately divergent, the longest (1.5) 2.4–4 mm long, with rare exceptions longer than tube; *petals* pale but clear yellow, fading pinkish-brown or brownish-purple, usually eglandular, the epistemonous ones perched well below middle of androecium; *banner* 2–3.4, rarely 5.2–6 mm long, the ventrally sulcate claw 0.8–2 (2.4) mm, the deltate-ovate or -cordate blade mostly 1–2, rarely 4 mm long, about as wide, the basal lobes confluent across top of claw but hardly elevated to form a cornet; *wings* 2.1–3.4 (4.8) mm long, the claw 0.8–1.5 (1.7–2.1) mm, the ovate-triangular blades 1–2 (2.9) mm long, 0.7–1.1 (1.6–1.8) mm wide; *keel* (2.6) 3–4.3 (5.8–6.2) mm long, the claws (1) 1.2–1.9 (2.8) mm, the oblong-ovate or -obovate blades 1.8–2.8 (3.8) mm long, 1.3–2 (2.4) mm wide; *androecium* (9) 10-merous, 3.5–5.5 (6.8) mm long, the longer filaments free for 1–1.4 (1.7–2) mm, the connective gland-tipped, the pallid or yellowish anthers 0.3–0.45 (0.6) mm long; *pod* 2.3–2.6 mm long, in profile triangular-obovate, the style-base at or below the distal corner, the prow slightly dilated, green or becoming brown or livid, the valves hyaline in lower ½, thence thinly papery, pilosulous, sometimes obscurely gland-sprinkled; *seed* 1.4–1.7 mm long; 2n = 14 (B. L. Turner; Mosquin). — Collections: 62 (x).

Desert grassland, cactus desert, mesquite-thorn scrub, or creosote (Larrea) desert, n.-ward entering high short-grass prairie, 1300–2430 m (± 4300–8100 ft), widespread and locally abundant, especially but not exclusively on limestone, over the Mexican Plateau and the Chihuahuan Desert, from Aguas Calientes and San Luis Potosí n.-ward into s.-w. United States, extending from San Luis Potosí s.-e. through Hidalgo probably just into extreme n. México and, apparently disjunctly, to the Tehuacán Desert in s.-e. Puebla; to be expected in Oaxaca (cf. discussion of *D. lachnantha* Schauer); in United States from trans-Pecos Texas (Davis Mts., Jeff Davis Co.) to s.-e. Arizona (Cochise, Santa Cruz, Pima cos.) and thence marginally into Sonora, in New Mexico n. up Rio Grande valley to n.-e. Socorro Co. and one old station (not verified recently) on the headwaters of the Pecos in San Miguel Co. — Flowering primarily August to November, sometimes again (or for the first time, following rains) April to June. — *Representative*: UNITED STATES. ARIZONA: *Griffiths & Thornber 213* (NY); *Barneby 2681* (NY); *Blumer 1728* (L, NY). NEW MEXICO: *Rose & Fitch 17,645*

(NY, US); *Barneby 13,837* (CAS, GH, NY, US); *Metcalfe 772* (NY). TEXAS: *Warnock 8042, 9298* (RENNER). MEXICO. SONORA: *Thurber 1098* (F, NY). CHIHUAHUA: *Stewart & Johnston 2023, 2103* (GH, TEX); *Pringle 601* (BR, F, NY, US), *347* (BR, F, MEXU, NY, UC); *Gentry 8251* (MEXU, MICH, UC, US). COAHUILA: *Johnston & Mueller 993* (GH, TEX); *Johnston 9412* (GH). DURANGO: *Gentry 6876* (F, NY), *6888* (NY); *Mosquin 6896* (DAO), *6904* (NY); *Ripley & Barneby 14,193* (NY). SAN LUIS POTOSÍ: *Purpus 5193* (F, NY, UC); *Ripley & Barneby 13,313* (MEXU, NY, UC); *Rzedowski 1850* (ENCB). TAMAULIPAS: *Ripley & Barneby 14,772* (NY). ZACATECAS: *Ripley & Barneby 13,467* (CAS, MEXU, NY); *Gentry 8535* (MICH, US). AGUAS CALIENTES: *Rose & Painter 7702* (NY, US). QUERÉTARO: *M. C. Johnston 2894* (TEX). HIDALGO: *Pringle 8732* (F, L, M, MEXU, NY, TEX, UC, US, W, Z); *Purpus 405* (UC); *González-Quintero 3048* (ENCB). PUEBLA: *Purpus 1205* (F, NY, UC); *Mosquin 6662* (NY); *Miranda 4516* (MEXU).

Dalea brachystachya (short-spiked) Gray, Pl. Wright. **2**: 39. 1853 ("*brachystachys*"). — "Valleys, in alluvial soil, between San Pedro and the Sonoita; Sept. ([*C. Wright*] *990*)." — Holotypus, GH! isotypi, NY, US! — *Parosela brachystachya* (Gray) A. Hell., Catal. N. Amer. Pl. ed. 2, 113. 1900, nomen (without citation); Rose, Contrib. U. S. Nat. Herb. **10**: 105. 1906.

Dalea lemmoni (John Gill Lemmon, 1832–1908) Gray, Proc. Amer. Acad. **17**: 200. 1882 ("*Lemmoni*"). — "Near Fort Bowie, Apache Pass, South Arizona [Cochise Co.], *Lemmon,* 1881." — Holotypus, *Lemmon 563*, GH! isotypus, NY! — *Parosela lemmoni* (Parry ex Gray) A. Heller, Catal. N. Amer. Pl. ed. 2, 6. 1900.

An inconspicuous little plant, with slender, sparsely leafy stems and small heads of flower that become stiffly barbate as the fruits mature, each calyx resembling and functioning as a Composite achene and pappus. The species is the only one at once glabrous to the spikes, annual or short-lived perennial in duration, and yellow-flowered, and is therefore easily recognized, at least at anthesis. Unlike the majority of annual daleas, *D. brachystachya* is rarely weedy, although when it does happen to seed into roadside gravels it profits from the increased water run-off and grows fat and leafy. In undisturbed grassland the plants vary from very slender, with few monocephalous stems incurved-ascending from the root-crown, to many-stemmed and relatively coarse, each axis then bearing a succession of leaf-opposed spikes elevated on slender or almost threadlike peduncles. The bracts are at least incipiently dimorphic, those at base of the spike broader and less densely ciliolate than the interfloral ones, sometimes forming a sort of involucre. The calyx-teeth also vary considerably in length, but are seldom shorter than the tube and usually longer than the corolla. As the pods mature the calyx-teeth diverge into a star, the plumose ciliae at the same time spreading widely. At the time Gray described *D. lemmoni* he had for comparison with *D. brachystachya* only its type and some cultivated progeny. The differential characters of more slender habit, narrower leaflets, and longer, more plumose teeth can be seen now, in the context of our ample material, to be unreal criteria, as already inferred by Tidestrom (in Tidestr. & Kitt., Fl. Pl. Ariz. 181. 1941). The characters adduced by Rydberg (1920, p. 68) to separate the two species are effective only in separating more and less adult specimens. In fact, following Rydberg's key, the mature plants grown at Cambridge from Wright's original *D. brachystachya* would be identified as *D. lemmoni*.

As already mentioned, the corolla of *D. brachystachya* is very small, the keel-blades only ± 2–3 mm long, not or little exserted from between the calyx-teeth. The high measurements for corolla-parts given parenthetically in the foregoing description are derived from an unusually large-flowered (but otherwise normal) form that has been collected twice in the foothills of Sierra Madre in central Chihuahua (*LeSueur 400*, ARIZ; *Ripley & Barneby 13,868*, CAS, NY). Because this unusual plant occurs well within the range of

typical small-flowered *D. brachystachya*, I interpret it as a minor variant, but it deserves further study.

Outside its natural range *D. brachystachya* has appeared as a waif on chrome ore piles at Canton, Maryland (*C. F. Reed 32,755* in Sept. 1953, herb. Reed.).

The nomenclature of *D. brachystachya* will not be securely settled until the identity of *D. lachnantha* Schauer, 1847, is established. The protologue of the latter fits *D. brachystachya* very closely indeed, and I would gladly have adopted the epithet, except for one obstacle. The type of *D. lachnantha* was said to have been collected in Oaxaca, and we have no modern evidence that the species extends south of the Tehuacán Desert in southern Puebla. Many species with similar dispersal patterns over the arid highlands of north-central Mexico extend, continuously or interruptedly, into the drier intermountain valleys of central Oaxaca, and *D. brachystachya*, a species easily overlooked, could well be of their number. If and when it turns up in Oaxaca, the claims of *D. lachnantha* (listed in Appendix I, q. v.) will need reappraisal.

IVC (xxvii). Series Filiformes Barneby

Very slender, erect, monocarpic herbs, glabrous up to the short, narrow, rather loose spikes; *leaves* 3–5-foliolate, the leaflets linear-filiform, resembling the rachis, the 3 uppermost issuing from the same point, precisely palmate; *calyx-teeth* triangular-acuminate; *petals* pinkish-purple, very small, the keel-blades ± 1.4–1.9 mm long; sp. 1, of Sierra Madre Occidental, from Durango n. into s.-w. United States.

Dalea subgen. **Parosela** sect. **Parosela** ser. **Filiformes** Barneby, ser. nov., radice annua, caule foliisque glaberrimis, foliolis 3–5 elongato-filiformibus rhachin simulantibus terminalibus 3 palmatim dispositis, floribus parvulis inter *Paroselas* genuinas praestantes.—Sp. unica: **D. filiformis** Gray.

143. Dalea filiformis Gray

(Plate L)

Slender, often exiguous annual herbs (4) 7–30 (35) cm tall, sometimes flowering before the cotyledons wither, glabrous to the inflorescence (the leaf-rachis rarely minutely ciliolate), the subfiliform erect angular-ribbed greenish or purplish stems simple only when depauperate, commonly branching from base upward, or from near or above middle, the peduncles both leaf-opposed and terminal, the sparse foliage green, punctate beneath; *leaf-spurs* very short or 0; *stipules* narrowly subulate, 0.5–1.3 mm long; *intrapetiolular glands* spiculiform; *post-petiolular glands* minute, immersed; *leaves* petiolate (the petiole shorter than the first pair of leaflets), 1–3.5 (4) cm long, with 3 or 5 linear-filiform involute obtuse to minutely emarginate leaflets 5–23 mm long; *peduncles* filiform, (1.3) 2–8 cm long, surpassing the leaf; *spikes* often few-flowered, depressed-capitate becoming ovoid or shortly oblong, without petals 5–7 mm diam, the villosulous axis (2) 3–15 (20) mm long; *bracts* deciduous, rhombic-elliptic or -ovate to ovate-acuminate, 1.5–2.8 mm long, submembranous at base, thence livid and glandular, the lowest glabrous, the upper pilosulous dorsally, all ciliolate; *calyx* at anthesis turbinate, later distended by the pod, (2.5) 2.8–3.5 mm long, pilosulous with loosely ascending straight hairs up to 0.5–1 mm long, the tube (1.3) 1.5–1.8 mm long, its orifice oblique but not strongly recessed behind banner, the filiform, livid or castaneous ribs becoming prominulous, the membranous intervals glandless or charged with 1 (2) minute glands, the triangular-acuminate or -aris-

tate, gland-spurred teeth 1.2–1.8 mm long (± as long or slightly shorter than tube); *petals* either concolorous, all pinkish- or reddish-purple, or the banner pale at anthesis and rubescent, all glandless, or the keel minutely gland-tipped, the epistemonous ones perched well below middle of androecium; *banner* 2.6–3.5 mm long, the claw 1.1–1.7 mm, the ovate or deltate-ovate blade 1.4–1.8 mm long, 0.9–1.6 mm wide; *wings* 1.8–2.4 mm long, the claw 0.5–0.8 mm, the obliquely lanceolate blade 1.2–1.8 (2) mm long, 0.5–0.7 mm wide; *keel* 2.4–3.2 mm long, the claws 0.8–1.5 mm, the ovate blades 1.4–1.9 mm long, 0.8–1.1 mm wide; *androecium* 10-merous, but the alternate stamens often reduced in size or obsolescent, the longer ones 2.5–3.5 mm long, free for 0.6–0.9 mm, the connective gland-tipped, the anthers pale, 0.25–0.3 mm long; *pod* obovoid, compressed, exserted from calyx-tube and ± as long as the teeth, 2–2.4 mm long, the style-base lateral, the valves hyaline in lower half, thinly papery distally; *seed* 1.5–1.9 mm long; 2n= 14 (Mosquin). — Collections: 42 (vi).

Shallow sandy and stony soils of open oak-pine woodland, coming out into grassland with juniper, 1680–2400 m (± 5900–8000 ft), rather common but inconspicuous and probably much overlooked, Sierra Madre Occidental from centr. Durango (mpos Durango and El Salto) n. through Chihuahua to Río Bavispe in Sonora, and around the headwaters of the Gila River from s. Arizona (Patagonia, Huachuca, Chiricahua mts.) through s.-w. New Mexico (Pinos Altos and Mogollon mts.) and thence n.-w. across centr. Arizona (White Mts. Santa Catalina Mts. and Mogollon Rim) to Hualpai Mt. in Yavapai County. — Flowering August to November. — *Representative*: UNITED STATES. ARIZONA: Yavapai: *Eastwood in 1929* (CAS, UC). Coconino: *Hanson A77* (NY, OKLA). Greenlee: *Pinkaava et al. 13,684* (NY). Pima: *L. Benson 9047* (POM, UC). Cochise: *Blumer 1638* (L, NY, W); *Barneby 5155* (CAS, NY). NEW MEXICO: Grant: *Metcalfe 1467* (NY, US); *Barneby 2515* (NY). MEXICO. SONORA: Babispe: *Turner, Dodge & Mason 2103* (ARIZ, MEXU). CHIHUAHUA: Madera: *Pennell 19,225* (NY). Cd. Guerrero: *Pringle 1211* (F, MEXU, NY). Cuauhtémoc: *Ripley & Barneby 13,878* (CAS, DAO, MEXU, NY, US). Gral. Trías: *Pennell 18,797* (GH, NY). Meoqui: *Gentry 2549* (ARIZ, UC). Hidalgo del Parral: *Townsend & Barber 277* (NY, US). DURANGO: V. Ocampo: *Reveal & Hess 3027* (NY). Durango: *Ripley & Barneby 13,499* (CAS, K, MEXU, MICH, NY, US). El Salto: *Ripley & Barneby 13,994* (CAS, NY).

Dalea filiformis (threadlike, of stem and leaflets) Gray, Pl. Wright. **2**: 39. 1853. — "Hillsides, near the copper mines [Santa Rita del Cobre, Grant Co.], New Mexico; Aug., in flower; Oct. in fruit. (992)." — Holotypus, collected by Charles Wright in 1851, GH! isotypi, NY, UC, US! — *Parosela filiformis* (Gray) A. Heller, Catal. N. Amer. Pl., ed. 2, 6. 1900.

Dalea hutchinsoniae (Mrs. W. Hutchinson) Jones, Extr. from Contrib. West. Bot. **18**: 42. 1933. — "Pinos Altos mts. N[ew] M[exico]. Sept. 23, 1931..." — Holotypus (Morton, Contrib. U. S. Nat. Herb. **29**: 102. 1945): *Jones 28,709*, dated Sept. 24, POM! isotypus, UC!

A frail, thinly leafy annual, *D. filiformis* is instantly recognized by its few (3–5, mostly 3) proportionately very long, threadlike leaflets of which the upper three form an exact trefoil. Other monocarpic members of sect. *Parosela* have the odd leaflet raised beyond the last pair. The species most like it habitally is *D. transiens*, differing technically in the free keel-petals of subgenus *Dalea* but more obviously in the more numerous (5–13) shorter and proportionately broader leaflets. Other annual daleas found in the range of *D. filiformis* all have leaflets of a broader type, either pilose or, if glabrous, then either much more numerous, or combined with persistent interfloral bracts.

The main range of *D. filiformis* lies in the forest belt of the Sierra Madre, but it has been traced out into the grasslands of the Conchos valley southeast of Ciudad Chihuahua and must be expected elsewhere in this environment.

IVC (xxviii). Series RECLINATAE Barneby

Obligately monocarpic, usually slender herbs (up to 4, rarely 5 dm tall), ± loosely pilose with fine spiral hairs; *inflorescence* moderately dense, spiciform; *calyx-teeth* subulate; *flowers* small, the epistemonous petals pinkish to yellowish-pink or dull purplish, the keel-blades mostly 1.6–2.5, rarely 2.9 mm long; spp. 2, of w.-centr. and s. temperate Mexico, one weedy and recorded once from Guatemala where possibly introduced.

Dalea subgen. **Parosela** sect. **Parosela** ser. **Reclinatae** Barneby, ser. nov., radice annua, caule foliisque ± pilosis, foliis imparipinnatis paucijugis, inflorescentia spiciformi densa sed haud strobiliformi, floribus parvulis inconspicuis inter affines dissimiles. — *Parosela* subgen. *Euparosela* XIII. *Alopecuroides* Rydb., p. p. — Sp. typica: **D. reclinata** (Cav.) Willd.

Key to the Species of Ser. *Reclinatae*

1. Stems solitary erect or with several subbasal incurved-ascending lateral branches, each of them terminating in a single peduncle, the spikes therefore well exserted above the foliage; *leaf-spurs* strongly developed, (1) 1.4–4 mm long. 144. *D. reclinata.*
1. Stems pliantly diffuse or early becoming so, the lateral ones quickly surpassing the central one, each sympodially branched, the peduncles all or mostly appearing leaf-opposed, much surpassed by leaf-bearing axes; *leaf-spurs* less than 1 mm long. 145. *D. humilis.*

144. DALEA RECLINATA (Cavanilles) Willdenow
(Plate CXXXI)

Annual herbs, (0.6) 1–4 (5) dm tall, simple and monocephalous only when depauperate, usually branching from near base and the lateral axes incurved-ascending, the stems glabrous and purplish-glaucescent in the lower ⅓, thence thinly pilose with fine weak spreading and ascending spiral hairs, the herbage green, the submembranous leaflets glabrous or medially glabrate above, paler and obscurely punctate or epunctate beneath; *leaf-spurs* (1) 1.4–4 mm long; *stipules* narrowly lance-acuminate or linear-caudate 3–7 mm long, usually livid; *intra-* and *post-petiolular glands* minute or 0; *leaves* petioled, (1) 1.5–4.5 cm long, with scarcely margined rachis and (1) 2–5 (6) pairs of narrowly to broadly elliptic, either obtuse and mucronulate or acute, flat or marginally elevated, often red-edged leaflets 2.5–12 mm long; *peduncles* terminal to each stem or branch, 1.5–10 (14) cm long; *spikes* moderately dense, at early anthesis ovoid or oblong becoming cylindroid, without petals 7–10 (13) mm diam, the hirsutulous axis 1–5 (6.5) cm long; *bracts* persistent until fall of calyx, ovate- or lance-acuminate, 3–6.6 mm long, membranous-margined and boat-shaped proximally, livid distally, thinly pilose dorsally with hairs minutely thickened at base, glabrous within; *calyx* 2.8–4 mm long, densely loosely silky-pilose, the tube 1.3–1.8 mm long, recessed behind the banner, the usually livid ribs filiform but finally prominent, the intervals hyaline, faintly minutely glandular, the teeth linear-subulate from a deltate base, 1.2–2 mm long; *petals* dull purplish-blue or pinkish, the banner with a pale, 2-lobed eye, the keel (detached) almost as long or a trifle longer than the banner, the epistemonous

petals perched well below middle of androecium, ± 0.7–1.5 mm above hypanthium; *banner* 2.7–4.2 mm long, the claw 1.6–2.4 mm, the triangular- or suborbicular-cordate blade 1.1–1.9 mm long, 1.3–1.8 mm wide; *wings* 2.8–3.7 mm long, the claw 1.1–2.1 mm, the oblong-oval blades 1.5–2.2 mm long; *keel* (2.4) 2.6–4 mm long, the claws 0.8–2.1 mm, the ovate blades 1.6–2.8 mm long; *androecium* 7–10-merous, 3.5–4.5 mm long, the longer filaments free for 0.7–1 mm, the purplish anthers 0.25–0.35 mm long; *pod* obliquely obovoid or triangular-obovoid in profile, 2.1–2.4 mm long, the latero-terminal style-base ± 0.4 mm long, the body compressed but plump, the dorsal crest slender, the prow filiform, the valves hyaline and glabrous in lower ⅔, thinly papery and villosulous distally; n = 7 (Spellenberg, 1973); 2n = 14 (Mosquin). — Collections: 52 (xiii).

Glades and sunny banks in pine or pine-oak forest, sometimes colonial and weedy along roadside banks and ditches, 1960–2700 m (6550–9000 ft), common within and around the periphery of Valley of Mexico in México (Edo and D. F.), adjoining Morelos, Puebla (on e. slope of Ixtaccihuatl) and Hidalgo (environs of Pachuca), w. along the Cordillera Neovolcánica through Michoacán as far as Volcán Paricutin and Zamora; disjunctly in Sierra Madre Occidental in s. Chihuahua (about Parral) and centr. Durango. — Flowering (August) September to December. — *Representative*: CHIHUAHUA: *Pennell 18,923* (GH), *19,139* (NY). DURANGO: *Ripley & Barneby 13,995* (CAS, NY), *13,964* (CAS, DAO, MEXU, NY, US). MICHOACÁN: *Ripley & Barneby 13,404* (MEXU, MICH, NY, US), *14,072* (CAS, NY, US); *Spellenberg 2964* (NY). MÉXICO (incl. D.F.): *Bourgeau 938* (BR, K, L, P); *Hinton 4880* (F, NY, Z); *Matuda 26,541, 27,699* (MEXU, NY); *Ripley & Barneby 13,389* (CAS, MEXU, NY, US). MORELOS: *Pringle 7049* (NY, US). PUEBLA: *Gentry 12,118* (USNA). HIDALGO: *Alexander 1752* (NY, UC); *Ripley & Barneby 13,634* (CAS, MEXU, NY, US).

Dalea reclinata (Cav.) Willd., Sp. Pl. **3**: 1340. 1801, based on *Psoralea reclinata* (prone, seldom appropriate) Cav., Ic. **1**: 60, pl. 87. 1791. — "Habitat in Mexico...vidi vivam [in hort. regio Matritensi]." — Holotypus, MA (herb. Cav.)! — *Petalostemon reclinatus* (Cav.) Steud., Nomencl. Bot. ed 2, **2**: 408. 1841. *Parosela reclinata* (Cav.) Rydb., N. Amer. Fl. **24**: 101. 1920, quoad nom., exclus. descr.

Parosela pilifera (pilose) Rydb., N. Amer. Fl. **24**: 75. 1920. — "Type collected at Pachuca, Hidalgo, September 1905, *Purpus 1741*, in part..." — Holotypus, so annotated by Rydberg, NY! isotypus, US! — *Dalea pilifera* (Rydb.) Bullock, Kew Bull. **1939**: 197. 1939.

Parosela townsendii (Charles Henry Tyler Townsend, 1863–) Rydb., N. Amer. Fl. **24**: 76. 1920 ("*Townsendii*"). — "Type collected in the Sierra Madre near Colonia Garcia [s. Chihuahua, near 106° W], September 4, 1899, *Townsend & Barber 301*." — Holotypus, US! isotypi, F, K, NY, Z!

Dalea argyrotricha (silver-haired) P. G. Wilson, Kew Bull. **1958**: 157. 1958. — "MEXICO: Federal District: camino de Toluca, 8000 ft...Oct. 1938, *E. K. Balls & W. B. Gourlay B.5566*..." — Holotypus, K! isotypi, NY, UC, US (p. p., mixed with *D. foliolosa*)!

Along the middle Transverse Volcanic Belt, from Lago Chapala on the west to Pachuca on the east, and again more locally in central Sierra Madre Occidental in Durango and Chihuahua, three superficially similar annual daleas, *D. reclinata*, *D. leporina*, and *D. thouini* may sometimes be found growing together or in near proximity. They are alike in habit, in green foliage, and in narrow cylindric spikes of silvery calyces borne terminal to the main stem and principal branches, and are often confused in herbaria. The present species, *D. reclinata*, differs from the rest in its valvately adherent keel-blades, typical of subgen. *Parosela*, but the petals are very small and fugitive and in practice it is more easily recognized by the presence on the upper stem and foliage of long weak spiral hairs, silvery when fresh but eventually rufescent when dried. The two other species have the free or

imbricate keel-blades of subgen. *Dalea* and are glabrous up to the flower-spikes; *D. leporina* differs further in its many leaflets and deciduous interfloral bracts, *D. thouini* in its internally silky bracts and gland-sprinkled petals.

The bicentric dispersal of *D. reclinata* is shared by *D. thouini* and by the likewise annual but very different *D. obreniformis*. None of this trio seems to have developed significantly different forms in the two segments of their range. Rydberg's *P. townsendii* was based on a collection from Chihuahua supposed to differ from *P. pilifera* of southern Mexico in its broader and more broadly scarious-margined bracts. Now that more material is available from Sierra Madre the bracts are seen to be variable in length and outline, as often in the genus, and Rydberg's segregate cannot be maintained at any taxonomic level.

In open forest around the periphery of the Valley of Mexico as formerly on hills rising from the valley floor, *D. reclinata* is one of the common late summer annuals and was, rather naturally, one of the first members of the genus to reach European gardens, being described by Cavanilles as early as 1791. The name was misunderstood by Rydberg, who was unaware of specimens preserved by Cavanilles in Madrid, and transferred the epithet to the prostrate form of *D. sericea* described below as var. *humistrata*. Rydberg may well have been led astray by the epithet *reclinata*, descriptive of the Oaxacan perennial dalea he had in mind, but inappropriate to the usually erect annual that is its proper owner. The initial mistake led to the description of *P. pilifera*, which is exactly *Psoralea reclinata* Cav. In describing *D. argyrotricha*, Wilson seems to have overlooked *D. pilifera* and *P. townsendii* entirely.

145. Dalea humilis G. Don
(Plate CXXXI)

Annual herbs from subfiliform roots, variable in stature, the primary axis erect only when depauperate and crowded, usually branching from near base and the diffuse, assurgent, or prostrate lateral stems surpassing the primary one, remaining simple or few-forking upward, all striate, eglandular, 0.5–4 dm long, pilose like the leaves with narrowly or widely spreading-ascending spiral hairs up to 1–3 mm long, the leaflets sometimes only thinly so and greenish; *leaf-spurs* less than 1 mm long, often subobsolete; *stipules* linear-lanceolate or -caudate, (2) 3–8 (11) mm long, herbaceous above immediate base, gland-tipped; *intrapetiolular gland* 1, spiculiform; *post-petiolular glands* 0 or minute and immersed; *leaves* petioled, the main cauline ones (1) 2–6 cm long, with obscurely margined, eglandular rachis and (1) 2–3 (4) pairs of linear-elliptic to ovate-elliptic, acute, gland-mucronulate, flat or loosely folded leaflets (2) 3–16 (18) mm long, the odd one longest and shortly distant beyond the last pair; *peduncles* mostly appearing leaf-opposed, slender, 2–8 cm long, either erect or divaricate from the stem and incurved under the spike; *spikes* relatively loose, the calyces nearly contiguous but not closely imbricated, 4–many-flowered, ovoid to cylindroid, without petals (but including bracts and pubescence) (6) 8–16 (17) mm diam, the axis becoming (0.2) 0.4–4 (5) cm long; *bracts* deciduous only with the ripe calyx and pod, ovate- to narrowly lance-acuminate, (2) 3–7 (8) mm long, pallidly membranous-margined at base, herbaceous distally, dorsally pilose and often minutely yellow-glandular; *calyx* sessile or almost so, 3.2–5.4 mm long, pilose externally with ascending spiral hairs, the tube 1.8–2.5 (2.7) mm long, recessed behind the banner, the ribs prominent, the membranous intervals eglandular or charged with 1 row of 1–3 minute transparent glands, the teeth triangular-subulate, gland-tipped, (1.2) 1.5–3.1 mm long; *petals* variably (indecisively) colored, the banner whitish or pinkish, the epistemonous

ones flesh-pink or yellowish, sometimes clearer rose-pink or purplish, perched near or slightly above middle of androecium; *banner* 3.5–4.8 (5) mm long, the claw 1.8–3.2 mm, the deltate-cordate, rarely rhombic-ovate blade 1.4–2.5 mm long; *wings* (2.2) 2.5–3.2 mm long, the claw 0.2–0.5 mm, the oblong-elliptic blade (2) 2.2–2.8 mm long, 0.9–1.4 mm wide; *keel* 2.4–3.4 (3.7) mm long, the claws 0.4–0.9 mm, the obovate blades 2.2–2.6 (2.9) mm long, 1.2–1.6 mm wide; *androecium* 10-merous (one stamen often barren), 3.7–6 mm long, the longer filaments free for 0.6–1.2 mm, the anthers dark blue, 0.2–0.3 mm long; *pod* deltate in profile, the sutures filiform, the valves hyaline and glabrous in the lower ⅔, thence thinly papery, pilosulous, eglandular; *seed* brownish-olivaceous smooth, 1.4–2.1 mm long; n = 7_{II} (Spellenberg, 1973). — Collections: 68 (xvii).

Plains, hillsides, in grassland, thorn-scrub, and degraded woodlands, becoming weedily abundant and densely colonial in disturbed soils along highways and in milpa, 1150–2500 m (3850–8325 ft), common almost throughout the Lerma-Santiago valley upstream from s. Nayarit, extending freely into Valley of Mexico and adjoining s. Hidalgo, n.-w., perhaps only as a roadside weed, into centr. Durango; again common at and near the lower edge of the oak-belt around the e. periphery of the Balsas Depression, from w. Michoacán to Puebla (where crossing feebly e. to the upper Papaloapan basin) and Guerrero, and s.-e. into centr. Oaxaca; apparently disjunct in highland Guatemala (Huehuetenango), but possibly not native there. — Flowering August to January. — *Representative*: MEXICO. DURANGO: *Ripley & Barneby 13,500* (MEXU, NY), *13,957* (NY). ZACATECAS: *Pringle 1758* (BR, M, NY, UC, US, W). NAYARIT: *Ripley & Barneby 14,053* (NY). JALISCO: *Palmer 573* (NY, UC, US); *Ripley & Barneby 14,519* (CAS, NY); *Rose & Painter 7616* (NY, US). AGUAS CALIENTES: *Gould 9007* (TEX, UC). GUANAJUATO: *Ripley & Barneby 13,347* (CAS, MEXU, NY, US). MICHOACÁN: *Arsène 8426* (US); *Ripley & Barneby 13,396* (MEXU, NY, US), *14,121* (CAS, NY). MÉXICO (incl. D. F.): *Pringle 6233* (BR, ENCB, F, M, MEXU, NY, UC, US, W, Z), *8726* (ARIZ, F, L, M, NY, OKLA, UC, W, Z); *Hinton 5030* (F, NY, W), *2617* (F, NY, MEXU). HIDALGO: *Ripley & Barneby 13,628* (CAS, NY). PUEBLA: *Arsène 1649* (NY, US); *Purpus 4145* (F, NY, UC). MORELOS: *Pringle 11,292* (F, NY, Z); *Berlandier 953* (OXF, P). GUERRERO: *Moore 5582* (BH). OAXACA: *C. L. Smith 546* (NY); *Ripley & Barneby 13,643* (NY), *14,589* (CAS, NY). GUATEMALA. HUEHUETENANGO: *L. O. Williams et al. 22,108* (NY).

Dalea humilis (lowly) G. Don, Gen. Hist. Dichl. Pl. **2**: 224. 1832. — "Native of Mexico. *Dalea herbacea* Sesse & Moc. ms." — Holotypus, formerly in herb. Lambert., not known to survive. Neotypus, labelled "*Dalea herbacea*", Herb. Sessé & Mociño *No. 2665*, MA! isotypi, F, and (ex herb. Shuttleworth. via Pavón) BM!

Dalea inconspicua (modest) Schauer, Linnaea **20**: 744. 1847. — "In pago Oaxacano Mexici. *Aschenborn n. 461.*" — Holotypus, formerly at B, destroyed, but the protologue decisive. — *Parosela inconspicua* (Schauer) Rose, Contrib. U. S. Nat. Herb. **10**: 105. 1906.

Dalea ervoides (tarelike) Benth. ex Hemsl., Diag. Pl. Nov. 6. 1878. — "Mexico: Real del Monte [near Pachuca, Hidalgo], *Coulter*, 537; Cuantepec [= Cuautepec, Morelos], *Bourgeau*, 1054." — Holotypus (*Coulter 537*), K! isotypus, US! — *Parosela ervoides* (Benth. ex Hemsl.) Rydb., N. Amer. Fl. **24**: 76. 1920.

Dalea barrancae (of the great canyon near Guadalajara) Jones, Extr. from Contrib. West. Bot. **18**: 43. 1933. — "No. 27230, La Barranca [Jalisco], Nov. 23 1930." — Holotypus (Morton, Contrib. U. S. Nat. Herb. **29**: 102. 1945), POM! isotypi, GH, NY, UC, US!

This is a truly weedy dalea, delighting in disturbed soils along roads and paths, where the plants often grow so thickly together in a tangle of diffuse thready stems as to exclude all but the rankest competitors. It is easily distinguished from compatriot annuals by the

combination of pilose vesture, few (mostly 2 or 3) pairs of expanded, sharp-pointed leaflets, and leaf-opposed peduncles, these of course structurally terminal to the axis of origin but surpassed by the axillary shoot that follows. The tiny petals are dimly pinkish or purplish, sometimes suffused with a dilute yellow tint; often they are concealed by the pilose calyx-lobes, and even when expanded are soon thrown off. In consequence the epithets *humilis* and *inconspicua* are descriptive. Because of its dowdy facies *D. humilis* is passed over by most collectors and actually much commoner than the herbarium record suggests.

Variation in the species is considerable, not only in stature but more especially in size of the individual bract and calyx, in absolute and proportionate lengths of calyx-tube and teeth, and in size of the petals, the full range of which is only suggested in the accompanying plate. Stature of itself has no taxonomic significance, the plant yielding with equal readiness, whether large or small-flowered, to accidents of environment. An extreme phase with one or few filiform stems bearing a few narrow heads of some 4–10 flowers appears distinctive when separated out on a herbarium sheet, but is often no more than a starveling extracted from a smothering crush of its own kind. A favored individual from the same roadside ditch can have many decumbent stems issuing from the primary axis, each bearing a succession of divaricate peduncles bearing plumply ovoid or cylindroid, clover-like heads of many flowers. The features within the inflorescence already mentioned as variable are at least loosely correlated, and whole colonies are often encountered that are nearly uniform in flower- and bract-size. Thus there is some ground for recognition of two infraspecific taxa corresponding with Rydberg's *Parosela ervoides* and *P. inconspicua*, respectively short and long in bract and teeth. The difficulty about such a treatment is twofold: the forms as envisaged by Rydberg are widely sympatric and of nearly the same total range; and there are now many collections ambiguous between the idealized norms. A particularly notable example of sympatric forms of *D. humilis*, one coarsely leafy and heavy-headed, the other of the slender *ervoides* type, is documented by *Ripley & Barneby 14,512* (NY, 2 sheets), collected on a grassy hill below the knobs at Tepoztlán in Morelos. In this station the two types occurred in a mixed population under uniform conditions of soil and exposure, and deliberate search failed to turn up anything intermediate among the many individuals of the two easily distinguished sorts. Probably, however, these monocarpic daleas with small, short-lived flowers of drab coloring are autogamous and therefore breed true to form, behaving in effect as discrete species even when closely associated with another strain. Breeding experiments are required to determine the nature of these phenetically different strains, but it is doubtful whether their existence will ever deserve formal taxonomic status.

The nomenclature of *D. humilis* presents vexing problems, largely due to the loss or destruction of types. The holotypus of *D. humilis* itself is lost or at least not identified as such in the herbaria known to have inherited parts of Lambert's herbarium (Miller, 1970). Don provided a clue to its identity by citing the manuscript binomial "*D. herbacea* Sessé", a name which turns up on two specimens dispersed by Pavón out of the Nueva España collection at Madrid. This seems, in conjunction with the short but convincing description, to fix application of the name, already suspected by Rydberg and accepted, without critical evaluation, by Clausen (Bull. Torrey Club **73**: 83). A potential prior synonym exists in shape of *Dalea acutifolia* S. & M. ex DC. (1825), for three separate sheets of *D. humilis* (at G, OXF, P), ostensibly from the same source, were distributed under that name by Pavón. DeCandolle's description of *D. acutifolia* was compiled not from a specimen but from one of Sessé's drawings, surviving as Calques des Dessins Pl. 228. This shows leaves suggestive of *D. humilis*, with the characteristic acute leaflets, but the massive spike is *subsessile* and *terminal* to an apparently erect stem and the foliage appears (and is described as) hairless. These last features, with the stylized but evocative figure of a detached flower, are more in accord with *D. cliffortiana* and cannot be reconciled with the Sessé specimens sent out as *D. acutifolia* by Pavón. For this reason I am listing *D. acutifolia*,

which I used in annotation for *D. humilis* during the early years of this study, in the synonymy of *D. cliffortiana*.

The name *D. ervoides* was based, as noted already, on the slender extreme with few-flowered spikes and short bracts. The detailed protologue of *D. inconspicua* dispels all doubt as to the specific identity of the plant described, but suggests, contrary to Rydberg's interpretation, a phase similar to *D. ervoides*. It appears, in fact, that no name is really available for the robust, thick-spiked aspect of *D. humilis*.

IVC (xxix). Series SERICEAE (Rydberg) Barneby

Herbaceous, variable in habit and stature, silky-pilose throughout, mostly rather coarsely leafy in the lower ⅓–½ of stems, these passing upward into stout (erect or humifuse) peduncles 1–6 dm long; *leaflets* of primary leaves 4–5 (6) pairs, mostly lanceolate and acute, some at least 1 cm long; *spikes* (raised far above foliage) very dense and usually massive, the closely contiguous flowers separated only by bracts that fall with the ripe calyx and pod; *calyx* densely pilose, its tube oblique at orifice, charged in the intercostal panels with few minute glands, nearly always shorter than the lance-aristate teeth; *petals* all violet-purple, or the ample banner with partly white (rubescent) blade, the violet pigment turning blue (or blue-purple) when dry, all glandless, the epistemonous ones long-clawed and low-perching, the detached keel only slightly longer than the banner, its blades ± 4.5–7 mm long. — Sp. 1, of s.-centr. and s. Mexico, n. on the Plateau to centr. Durango and Querétaro, s. into highland Guatemala and Honduras.

Dalea subgen. **Parosela** sect. **Parosela** ser. **Sericeae** (Rydberg) Barneby, comb. nov., based on *Parosela* subgen. *Euparosela* XXXII. *Sericeae* Rydb. Rydb., N. Amer. Fl. **24**: 100. 1920. — Sp. typica: *P. sericea* (Lag.) Rose = **Dalea sericea** Lag.

146. DALEA SERICEA Lagasca
(Plate CXXXII)

Perennial herbs, diverse in habit and stature, the stems stout and stiffly erect, or slender and incurved-ascending, or humifusely radiating from a woody root and (in age) a short caudex, including peduncles (2) 2.5–15 dm tall, like the foliage silky-pilose throughout with subappressed and narrowly ascending, often mixed with some or many spreading hairs up to (0.8) 1–2.5 mm long, the leaves green or greenish-silvery, pubescent both sides but sometimes thinly so above; *leaf-spurs* 0.5–1 (1.5) mm long; *stipules* narrowly lance-acuminate or linear-caudate, (3) 4–11 (17) mm long, pilosulous dorsally, glandless, often purplish; *intrapetiolular glands* spiculiform, or 0; *post-petiolular glands* immersed, or 0; *leaves* subsessile or short-petioled, the primary cauline ones (1.5) 2–6 cm long, with (2) 4–5 (6) pairs of elliptic, oblanceolate, or oblong-elliptic, acute to short-acuminate, flat leaflets (4) 5–20 (22) mm long; *peduncles* terminal and continuous with the main stem-axis or its (usually few) branches, (1) 1.5–5 dm long, often half or more than half the length of the whole plant; *spikes* very dense, oblong-cylindroid or the shorter ones ovoid when young, without petals (1) 1.3–2.1 cm diam, the densely pilosulous axis (1) 1.5–7 (8.5) cm long; *bracts* deciduous only with the ripe pod, lance-caudate, 4–9 mm long, the lowermost (often barren) firm, densely villous dorsally, the interfloral ones boat-shaped,

embracing the calyx, pallid or roseate at base, broadly scarious-margined, the keel and tail livid and villous, the tail slightly shorter to much longer than the body; *calyx* 4.6–8.7 mm long, densely villous-pilose externally, the tube 2.5–3.3 mm long, its orifice oblique, the ribs filiform, little prominent, usually livid, the pallidly membranous intervals glandless or charged with ± 1–3 minute transparent glands, the narrowly subulate to lance-aristate, livid, plumose teeth (1.8) 2.5–5 (5.8) mm long, commonly as long up to 3 mm longer than tube, rarely a little shorter than it; *petals* wholly or largely violet purple, drying blue or bluish-purple, rarely reddish, the blade of banner sometimes with white (rubescent) eye or white except for partly blue margin or blue basal lobes, all glandless, the epistemonous ones low-perching, well below middle of androecium; *banner* 5.7–9 mm long, the claw (2.6) 2.8–4.8 mm, the deltate-cordate and obtusely shallowly 3-lobed or sometimes suborbicular, subacute to emarginate blade (3) 3.2–5 mm long, 3.2–5.2 mm wide; *wings* (5.1) 5.5–8.5 mm long, the claw 1.4–3.1 (3.5) mm, the elliptic-oblanceolate blade (3.8) 4.3–6.7 mm long, (1.5) 1.7–2.9 mm wide; *keel* 6.5–10 mm long, the claws (2.2) 2.4–4 (4.5) mm, the broadly obliquely obovate blades 4.3–6.8 mm long, (2.5) 2.8–4.3 mm wide; *androecium* 10-merous, 7–11 mm long, the longer filaments free for 1.5–2.5 mm, the connective usually minutely gland-tipped, the anthers (0.5) 0.55–0.8 (0.9) mm long; *pod* in profile varying from semi-ovate to deltate, 2.1–2.7 mm long, the ventral suture straight or slightly convex, the dorsal one strongly convex or abruptly incurved into the filiform prow, the valves hyaline in the lower half, thence thinly papery, densely ascending-pilose, eglandular; *seed* brown or olivaceous, 2.1–2.8 mm long; x = 7.

The superficially polymorphic *D. sericea*, a species common through the temperate highlands from west-central through southern Mexico into Guatemala and Honduras, is distinguished from all sympatric daleas by the combination of herbaceous growth-habit, pilose vesture, few (mostly four or five) pairs of flat expanded leaflets, and dense spikes of bluish-violet, sometimes white-variegated flowers borne aloft, well beyond the last leaves, on long naked peduncles. It resembles some members of sect. *Cylipogon* in habit and vesture, but differs in the simple crest of the pod and the blue, not yellow pigmentation of the petals. In the context of sect. *Parosela*, the close kindred of *D. sericea* seem to be the small-flowered annual species of the ser. *Reclinatae* immediately preceding.

My concept of *D. sericea* is equivalent in scope to Rydberg's *Parosela Sericeae*, a group of three taxa conceived and technically separated primarily in terms of growth-habit. Much of the now ample material can still be sorted neatly into Rydberg's three categories, but much cannot, and there appear to be no morphological discontinuities within the complex of the sort expected in genuinely discrete species. The entity segregated by Rydberg under the misplaced epithet *reclinata* has some claims to recognition because, in addition to some weak morphological characters, it has acquired a distinct zonal range above that of typical *D. sericea*; it is maintained here as a newly described variety.

Key to the Varieties of *Dalea sericea*

1. Stems stiffly erect or assurgent from an incurved base, commonly few from each root, simple or basally spurred, monocephalous or more rarely 3–5 (7)-branched distally, the single (or when several the central) peduncle mostly 1.5–5 dm long, often longer than the leafy stem proper; *spikes* thick, without petals 13–20 (21) mm diam (in Oaxaca, where approaching the next, mostly ± 15 mm diam); *calyx* ± 5.8–8.5 mm long, its dorsal tooth 2.8–5.8 mm long, nearly always longer than the tube; *keel-blades* 4.6–6.8 mm long; widespread from Durango to Vera-

cruz and Honduras; where nearly sympatric with the next found at lower elevations, mostly below the pine-oak belt. 146a. var. *sericea*.

1. Stems pliantly humistrate, usually numerous, radiating from the root-crown and branched both near the base and distally, forming mats of silvery foliage pressed to the ground, only the 3-several spikes incurved to vertical, the central peduncle 1-3 dm long but shorter than the leafy stem proper; *spikes* more slender, without petals 10-13 mm diam; *calyx* 4.6-5.5 mm long, its longest (dorsal) tooth 1.8-3 mm long, ± as long up to 1 mm shorter than the tube; *keel-blades* 4.3-5 mm long; locally abundant in pine-oak forest of centr. Oaxaca and of Sa. Madre del Sur in centr. Guerrero. 146b. var. *humistrata*.

146a. Dalea sericea Lagasca var. sericea
(Plate CXXXII)

Stems vertical or incurved, not humifuse; *peduncles* mostly longer than the stem's leafy axis; *flower* relatively large, and calyx long-toothed (cf. key); *androecium* 8.5-11 mm long; n = 7 (Spellenberg, 1973); 2n = 14, 7_{II} (Mosquin). — Collections: 103 (xi).

Dry rocky and gravelly hillsides, ascending into sunny openings or glades in oak or oak-pine forest, coming out n.-ward into grama grassland, mostly between 1450 and 2600 m (± 4830-8650 ft), widespread in temperate s. Mexico from around the w. and s. margin of the Meseta Central (w.-centr. Durango to Guanajuato, Valley of México, centr. Puebla and adjoining Veracruz) s. through the Cordillera Neo-volcánica, Sierra Madre del Sur, and mountainous interior Oaxaca to the highlands of Chiapas, Guatemala, and Honduras. — Flowering July to January. — *Representative*: MEXICO. Durango: *Palmer 800* (F, NY, UC, US); *Ripley & Barneby 14,167* (DS, NY). Zacatecas: *M. Rodríguez in 1966* (ENCB). Jalisco: *Pringle 2799* (F, UC), *11,426* (F, L, MEXU). Guanajuato: typus of *D. gracilis* (vide infra). Querétaro: *Waterfall 13,970* (F, OKLA). Michoacán: *Hinton 13,425* (NY, UC); *Ripley & Barneby 13,417* (CAS, NY, MEXU, US), *14,126* (CAS, DAO, NY). México: *Pringle 3182* (F, M, NY, UC, W, Z), *8999* (BR, ENCB, F, L, M, NY, UC, US, W); *Ripley & Barneby 13,386* (CAS, MEXU, MICH, NY, US). Hidalgo: *Moore & Wood 4860* (UC); *Rose, Painter & Rose 1974* (NY, US). Puebla: *Purpus 2478* (F, UC). Veracruz: *Bourgeau 3174* (BR, P). Morelos: *Ripley & Barneby 14,544* (NY). Guerrero: *Hinton 14,772* (ARIZ, NY, W); *E. W. Nelson 2179* (NY, US). Oaxaca: *Ripley & Barneby 14,624* (DAO, NY, US), *14,629* (NY). Chiapas: *Matuda 1968* (ARIZ, F, NY); *Breedlove & Raven 13,092* (US). GUATEMALA. Alta Verapaz: *von Türckheim II-2048* (BR, F, L, W). Chimaltenango: *Standley 57,967* (F). Guatemala: *A. Rodríguez 1382* (F). Huehuetenango: *Standley 65,842, 81,512, 81,945* (F). Jalapa: *Steyermark 32,589* (F). Sacatepéquez: *Standley 61,741* (F). HONDURAS. Comayagua: *L. & R. Williams 6281* (F). El Paraíso: *A. Rodríguez 1782* (F). Morazán: *Standley 15,237* (F).

Dalea sericea (silky) Lag., Gen. & Sp. Nov. 23. 1816. — "Habitat in Nov. Hisp." — No typus survives at MA, but the protologue traditionally accepted in the current sense. — *Parosela sericea* (Lag.) Rose, Contrib. U. S. Nat. Herb. **10**: 105. 1906.

Dalea gracilis (slender) Kunth, Mimoses 166, Pl. 48. 1819. — "Crescit in Regno Mexicano, prope urbem Guanaxuato, alt. 1700 hex." — Holotypus, P (herb. H. B. K.)! isotypus, labelled "*D. pedunculata* Bonpl.", P (herb. Bonpl.)! — *Parosela gracilis* (Kunth) Rose, Contrib. U. S. Nat. Herb. **10**: 105. 1906.

Dalea alopecurus (fox-tail, of the spike) Sessé & Moc. ex G. Don, Gen. Hist. Dichl. Pl. **2**: 223. 1832. — "Native of Mexico...(v.s. in herb. Lamb.)." — Holotypus not known to

survive, but most probably it was an isotypus of *Psoralea alopecurus* S. & M. sold to Lambert by Pavón; cf. infra.

Dalea alopecurus "Ruiz & Pavón" ex Moric., Mém. Soc. Genève 7: 250, Pl. 8. (= Pl. Nouv. d'Amér. 10, Tab. VIII.). 1836. — "Hab. in Mexico, in las Cordilleras de Guchilapa [= Huitzilac, n. of Cuernavaca, Morelos]," the collector not mentioned. — Holotypus, *Berlandier 1022*, collected in oct 1827, G (labelled "Cord. de Guchilaque"); isotypi, G ("Cord. de Guchilapa"), OXF, P! paratypus, a Sessé & Mociño collection sent by Pavón as *Dalea alopecurus*, G! = isotypus of the next.

Psoralea alopecurus Sessé & Mociño, Fl. Nov. Hisp. 120. 1889. — "Habitat in Chilapae pratis [Guerrero]." — No holotypus so identified in herb. *S. & M.*, although *Nos. 2658, 2663, 2674* (F) belong here; presumed isotypi distributed by Pavón as "*Dalea alopecurus*", BM, G, P!

Variation immediately apparent in the material assembled here under the title of var. *sericea* is expressed primarily in growth-habit and stature. Along the western and southern cordilleras, from Durango into Honduras, and locally on the Gulf slope in Veracruz, the plants are almost uniformly robust, consisting at maturity of one or few sutrdily erect, most commonly monocephalous stems that pass distally into a peduncle 2–5 dm long, seemingly continuous with the leafy axis. From root to spike the plant measures 5–12, rarely 15 dm in height. On the south edge of the Central Plateau, subject to a more arid climate, the average plant is relatively small and slender, with incurved-ascending, pliant stems passing into a peduncle about 1–2.5 dm long, this usually longer than the leafy portion. All of the material collected in Guanajuato, Hidalgo, and in the valley of Mexico conforms more or less closely to this lowly phase, beautifully portrayed by Kunth as *Dalea gracilis*, whereas the robust phase of wider dispersal corresponds with *D. alopecurus* S. & M. Generally the taller plant has thicker spikes of relatively large calyces, but there is no firm correlation between flower-size and habit. The pubescence of the *alopecurus*-phase tends to be looser and longer than that of the *gracilis*-phase, but the difference is elusive. Size of petals varies independently of the calyx (and hence of spike-diameter). While most of the specimens seen could be sorted artificially by size alone, the decision one way or another is highly arbitrary, and the problem is aggravated in the field by intrapopulational variation. If Rydberg's two categories corresponding with *Parosela sericea* and *P. gracilis* should, despite intergradation, be evaluated as geographic phases worth taxonomic notice, a vexatious problem of nomenclature will arise, for although *D. sericea* Lagasca is surely the oldest name available for the whole species, no holotypus has survived and the description is too short to indicate which phase of it was being described. Specimens of both were collected by Sessé and collaborators and must have been available in Madrid by 1816. It is tempting to suppose that Lagasca was actually describing the plant preserved in the Sessé herbarium as *Psoralea sericea*, but proof of this connection is hardly possible.

The banner of var. *sericea* shows interesting variations in form and color of the blade. This may be solid blue, blue with a white eye, or white except for blue bands around the outer and lower margins, the white part in any case turning reddish after fertilization of the flower. Ordinarily the blade is bluntly and shallowly three-lobed, with the central lobe commonly subacute or mucronulate. A race common locally in the Sierra Madre foothills west of Ciudad Durango differs from the norm in having a round, apically emarginate blade.

146b. Dalea sericea Lagasca var. humistrata Barneby
(Plate CXXXII)

Stems usually numerous, humifuse, branching near base and distally, forming mats of silvery-gray foliage, each main axis usually several-headed; *peduncles* mostly shorter

than the leafy axis, incurved under the subvertical spike; *flower* relatively small, and calyx-short-toothed (cf. key); *androecium* ± 7–8 mm long. — Collections: 8 (iv).

Sunny openings and barren gravelly ridges in oak-pine forest, ± 1930–2130 m (6425–7100 ft), locally abundant, mountains of central and south-central Oaxaca, extending w. along Sierra Madre del Sur into centr. Guerrero. — Flowering September to December, probably later. — *Representative*: GUERRERO. Chilpancingo: Cerro Alquitrán near Mazatlán, *Rzedowski 23,641* (ENCB). OAXACA. Etla: Las Sedas, *Pringle 6020* (BR, ENCB, F, M, NY, UC, W); Sierra San Felipe, n. slope, *Ripley & Barneby 14,610* (NY); n. of Telixtlahuaca, *Ripley & Barneby 14,669* (NY). Asunción Nochixtlán: cf. typus. Miahuatlán: s. of Miahuatlán, *Ripley & Barneby 14,638* (NY).

Dalea sericea Lag. var. **humistrata** Barneby, var. nov., a var. *sericea* caulibus demum numerosis basi et supra medium ramosis omnibus prostratis flexuosim humi appressis, spicis angustioribus (petalis delapsis 1–1.3 nec 1.3–2 cm diam), calycisque dentibus brevioribus, dorsali tubo subaequilongo vel breviori absimilis. Habitat in querceto-pinetis supra graminum zonam cui var. *sericea*, si adsit, saepissime adhaeret. — *Parosela reclinata* sensu Rydb., N. Amer. Fl. **24**: 101. 1920, quoad descr., exclus. basionym. *Psoralea reclinata* Cav. — OAXACA: thin oak-pine forest, forming mats of foliage up to 1 m diam on granitic or andesitic bedrock, ± 2010 m (6700 ft), in the mountains of Mixteca Alta ± 27 km s.-e. of Nochixtlan, nov 10, 1966, *Ripley & Barneby 14,588*. — Holotypus, NY; isotypi, CAS, DAO, MEXU, MICH, UC, US.

The entity described herein as var. *humistrata* was already recognized in Rydberg's revision of *Parosela* as *P. reclinata*, a name properly belonging to a related annual dalea (see ser. *Reclinatae* immediately preceding); it is new here only in name and taxonomic status. Until I had seen it growing I interpreted Rydberg's scanty material as another phase, comparable with but more extreme than the so-called *D. gracilis*, of an inclusive *D. sericea*, for the supposed differences in flower-color and width of scarious margin to the bracts seemed, as they still do, inconsequential. Rydberg did point out that the stems of his *P. reclinata* branched toward the base, unlike those of *P. sericea* sens. str., but it was only in the field that I learned they are also pliantly prostrate, thus forming a mat of silvery foliage, surrounded by a ring of spikes incurved to vertical, unlike any known phase of genuine *D. sericea* whether robust or slender. In Oaxaca var. *sericea* and var. *humistrata* are close neighbors, but separated by life-zone. Ascending the Sierra Madre south of Miahuatlán I encountered on grassy hillsides in the lower fringes of the oak-belt characteristic, coarsely erect var. *sericea* with one or few massive spikes of long-toothed calyces, while only a few tens of meters higher, on cooler slopes in pine-forest, appeared var. *humistrata*, typical and abundant. Search in this region for intermediates was unsuccessful, and I formed the impression, reenforced by observation of both elsewhere in the valley of Oaxaca, of two truly independent populations.

IVD. Sectio PSOROPOGON Barneby

Herbs, annual or perennial, glabrous to the calyx, the leaflets dotted beneath; *spikes* either loose or moderately dense, never conelike; *bracts* broadly ovate, enveloping the young buds, either persistent or deciduous before anthesis; *calyx* densely silky-pilose or -pilosulous, the longest tooth either longer or shorter than the tube; *petals* white or more commonly all or partly pink, purple, or blue, the banner either a little longer or shorter than the detached keel, this perched near or below middle of the 9–10-merous androecium; *pod* like that of sect. *Parosela* in profile, but the dorsal suture thickened below the style, either dilated and plane or 2-carinate lengthwise across the pod's leading edge; x = 7. — Spp. 4, of centr. and s.-w. United States and Mexico, 1 extending into Central America and adventive in n. South America.

Dalea subgen. **Parosela** sect. **Psoropogon** Barneby, nom. et stat. nov., based on *Parosela* subgen. *Euparosela* XXX. *Pogonatherae* Rydb. N. Amer. Fl. **24**: 96, char. mut. 1920.— Sp. typica: *P. pogonathera* (Gray) Rydb. = **Dalea pogonathera** Gray.

Under the heading of sect. *Psoropogon* are brought together Rydberg's two groups *Parosela Pogonatherae* and *Citriodorae*, but these are preserved intact at the level of series. In *North American Flora* they were artificially separated by duration of the root, the *Citriodorae* being monocarpic, the *Pogonatherae* more enduring, although never frutescent. They are alike in their glabrous dotted foliage, very broad, scarious- or hyaline-margined bracts which envelop the young flower-buds (but may be thrown off early or late), and in the dilation of the dorsal suture across the pod's leading edge. A thickened prow of this sort is found elsewhere in the isolated *D.* (subgen. *Dalea*) *emarginata* and in the section next following, *Cylipogon*. The latter differs in its copiously pilose stems and foliage, yellow petals, and notably different facies.

Key to the Series and Species of Sect. *Psoropogon*

1. Perennial herbs; *leaflets* few, 2–6 pairs in main cauline leaves; *bracts* persistent through anthesis, falling only with the ripe fruit; *prow* of pod 2-carinate; (i) series *Psoropogon* (3 spp).
   2. Stems several or numerous, loosely tufted, diffuse or incurved, sometimes prostrate, not over 3.5 dm long, simple and monocephalous or bearing above middle 1–2 (4) monocephalous branches; *spikes* moderately dense, the flowers subcontiguous; *petals* violet, magenta, or at least purple-tinged.
      3. Calyx-teeth either longer or shorter than tube but, if shorter, the tube only 2.6–3.3 mm long; *vesture* of calyx commonly plumose (longer hairs on teeth 0.8–2.2 mm); *nerves* lateral to base of calyx-teeth exactly marginal; *banner* usually glandless, not or little exserted; *if calyx-teeth* shorter than tube the keel-claws only 0.8–1.3 mm, blades 3.5–4.8 (5) mm long; *anthers* 0.4–0.7 mm long; Texas to s. Arizona and Sonora, s. to Nuevo León and e. Durango. 147. *D. pogonathera.*
      3. Calyx-teeth always shorter than tube (by 0.5–1.8 mm) and the tube relatively long (3.3–3.9 mm); *vesture* never plumose, silky-pilosulous (hairs 0.55–1 mm); *nerves* lateral to base of calyx-teeth intramarginal; *banner* gland-sprinkled in the usually yellow eye, the blade well exserted; *keel* relatively large, the claws 1.5–2.4 mm, the blades 5.3–6.5 mm long; *anthers* 0.8–1.2 mm long; w. Texas and Coahuila to coastal Tamaulipas and centr. Nuevo León. 148 *D. lasiathera.*
   2. Stems few or solitary, erect, 5–12 dm tall, above middle repeatedly branching into a broad-headed panicle of many narrow, loosely-flowered spikes, the flowers mostly separated by distinct intervals; *petals* white; widespread over United States prairies s.-ward from North Dakota to Texas, w. to New Mexico and e. to the Mississippi valley in Iowa and Missouri. 149. *D. enneandra.*
1. Annual herbs (sometimes tall and not obviously so in pressed specimens); *leaflets* 9–15 pairs in most cauline leaves; *bracts* deciduous before anthesis; *prow* of pod flat, corneous; (ii) series *Citriodorae* (monotypic). 150. *D. foliolosa.*

IVD (i). Series Psoropogon

Perennial herbs, the stems dying back to the crown of a yellow root or to a shortly forked caudex at ground-level; *foliage* glaucescent, the narrow, thick-textured leaflets

conspicuously punctate, in main cauline leaves 2–6 pairs; *bracts* persistent until fall of ripe fruit; *petals* white or violet- to magenta-purple, the banner with a discolored eye; *prow* of pod 2-carinate. — Spp. 3, of the Mexican Plateau n. of the Tropic line and w. United States from Texas to s.-e. Arizona, 1 extending n. on prairies to North Dakota, w. Iowa, and n.-w. Missouri.

Dalea subgen. **Parosela** sect. **Psoropogon** ser. **Psoropogon.** *Dalea* subgen. *Parosela* (Cav.) Barneby sect. *Psoropogon* Barneby sens. str., q. v. supra. — Sp. typica: **D. pogonathera** Gray. — *Parosela* subgen. *Euparosela* XXX. *Pogonatherae* Rydb., N. Amer. Fl. **24**: 96. 1920, sens. str.

This series, already defined by Rydberg, seems one of the most natural. Its members have in common relatively few (at most six) pairs of narrow, glaucous and dotted leaflets, and large, pallid-margined bracts that embrace the calyx and are charged on the back with an ornamental pattern of elevated glands. The distinction between a "vexillate" and a "carinate" flower cannot be maintained in the series, for the banner (as in the related sect. *Cylipogon*), although always long-stalked and ample in the blade, may be either longer or shorter than the detached keel. The pod is similar to that of sect. *Cylipogon* also, its bicarinate prow (structurally the distal half of the greatly incurved dorsal suture) being concealed in profile view by a dense crest of hairs, but appearing grooved lengthwise when viewed head on. Rydberg placed his *Aureae* and *Pogonatherae*, the equivalents of *Cylipogon* and *Psoropogon*, side by side, evidently aware of a kinship between them, despite a superficially different aspect. It is interesting to note how closely the ranges of the two groups coincide, at least north of the Tropic line. Both have primary centers of speciation in south-central Texas and it seems reasonable to suppose that their histories have followed parallel paths divergent from a remote common source.

147. DALEA POGONATHERA Gray
(Plate CXXXIII)

Low perennial herbs from a forking orange root and shortly branched or pluricipital knotty caudex, glabrous up to the calyx, the several or numerous, decumbently radiating to weakly ascending, pallid, sparsely glandular but scarcely verruculose stems (0.4) 0.7–3.5 dm long, simple or branched at 1–2 (4) nodes above the middle, each axis monocephalous, the foliage smooth, the leaflets yellowish-green above, glaucous and livid-punctate beneath; *leaf-spurs* 0.1–0.8 mm long; *stipules* narrowly triangular-acuminate to subulate or linear-attenuate, (0.7) 1–2.6 mm long, becoming papery and brownish but the margins pallid-scarious, especially on the side opposite the petiole; *intrapetiolular glands* 0; *post-petiolular glands* prominent, obtuse, often crateriform when dry; *leaves* (0.4) 0.8–2 (2.5) cm long, short-petioled, with punctate, narrowly margined rachis and (1) 2–3 (4) pairs of narrowly oblanceolate to narrowly oblong-elliptic or linear-oblong, emarginate, thick-textured, marginally elevated or loosely folded leaflets (1.5) 2–10 mm long; *peduncles* 0.5–4 cm long; *spikes* relatively loose, (8) 12–40-flowered, the flowers becoming ± 2–3-ranked when pressed and not concealing the glabrous axis, without petals or androecia 9–18 (20) mm diam, (0.5) 1–8 cm long; *bracts* persistent, embracing the calyx, broadly ovate, cucullate and truncate at base, abruptly short-acuminate or mucronate at apex, 3–6 mm long, 3.2–5 (5.5) mm wide, in the lower ⅔ membranous-margined, dorsally keeled and the herbaceous middle pallid- or pinkish-glaucescent and gland-tuberculate; *calyx* (5) 5.2–10.5 mm long, the densely villosulous tube 2.6–3.4 mm long, the ribs filiform becoming prominent, the submembranous intervals charged with 1 row of 4–7 small,

pallid or honey-colored glands, the deltate- or broadly triangular-aristate teeth 1.9–7.2 mm long, varying from 1 mm shorter to 2.8 (4) mm longer than tube, plumose with spreading spiral villi up to 0.8–2.2 mm long; *petals* pale or vivid violet-purple, glandless, or the banner rarely charged in the pallid or greenish, finally rubescent eye with 1–2 small glands, the epistemonous ones perched near middle of androecium; *banner* (4.5) 4.8–7.8 mm long, the claw (2.5) 3.3–4.7 mm, the broadly ovate, emarginate, deeply cordate blade 2–3.6 mm long, 2.4–4 mm wide; *wings* 2.4–4.2 mm long, the claw (sometimes shorter than the auricle, appearing lateral) 0.3–1.2 mm long, the obliquely ovate or oblong-ovate blade 2.3–3.9 mm long, 1.2–2.1 mm wide; *keel* 4.2–7 mm long, the claws 0.8–1.8 (2.4) mm, the oblong-elliptic or obovate blades (3.4) 4–5.8 mm long, 1.9–3.1 mm wide; *androecium* 9- or 10-merous, (6.5) 7.5–10.5 mm long, the longer filaments free for 1.7–3 mm, the connective glandless, the pallid anthers (0.4) 0.5–0.7 mm long; *pod* 2.8–3.5 mm long, glabrous and hyaline in the lower ¾, thence firm and densely ascending-pilosulous, the prow broad, grooved between the prominent margins; *seed* castaneous or mahogany-brown, smooth and lustrous, 1.9–2.4 mm long.

The two purple-flowered *Pogonatherae, D. pogonathera* and *D. lasiathera*, are closely related and habitally very similar, the pale, sparsely glandular stems, glaucous punctate foliage, and broadly membranous-margined, gland-dotted bracts being essentially identical. Rydberg (1920, p. 70) separated them by means of calyx-measurements, attributing to *D. lasiathera* teeth much shorter, to *D. pogonathera* teeth as long or longer than the tube. As a result some of the small-flowered Texan forms of *D. pogonathera* var. *walkerae* were wrongly referred to *D. lasiathera*. Because of the great variation in size of the flower encountered in *D. pogonathera*, a more complex formula is required for a really effective key. It is remarkable that the range of *D. lasiathera* lies entirely within that of *D. pogonathera* and that the two species can exist side by side without any sign of introgression or blurring of specific lines. It is interesting, nevertheless, that on Edwards Plateau where *D. lasiathera* is most abundant *D. pogonathera* is less often encountered; conversely outside the Plateau, where *D. pogonathera* is the commonest, almost ubiquitous dalea, the stations of *D. lasiathera* are far and few.

The range of *D. pogonathera* extends from sea-level on the Gulf Coast up to nearly 1900 m on the Mexican Plateau and to similar elevations in Arizona. It is found in a great variety of habitats and on soils of diverse origins, but exhibits little structural variability except in size and relative proportions of the calyx and petals. At one extreme the flower spike (without petals) may measure 2 cm, at the other barely 1 cm in diameter; and the dorsal calyx-tooth varies from 1 mm shorter up to 4 mm longer than the tube. The size of flowers is well correlated with dispersal and permits an arbitrary division of the material into a lowland, eastern, small-flowered var. *walkerae* virtually confined to the Rio Grande valley downstream from the mouth of the Pecos and the Texan Gulf Prairie, and a large-flowered, upland and western var. *pogonathera*. In the foothills of Sierra Madre near Monterrey, and in east-central Coahuila and adjoining Texas, the species passes through a zone of transition where intermediate forms predominate. Here the division of the species into two varieties on the basis of a single character (dorsal calyx-tooth more or less than 4 mm long) is revealed for what it is, a taxonomic artifice which, nevertheless, is justified in practice over an immense tract of territory. The holotype of *D. pogonathera* stands unfortunately among the specimens which are essentially intermediate. It is here interpreted, following Turner (1959), as belonging to the large-flowered, upland series, the longest calyx-tooth reaching 4 mm, and the hairs at mouth of the calyx being relatively long (± 1.5 mm). The type-station, somewhere in the Sierra Madre foothills near Monterrey, is situated near the belt of intergradation just mentioned.

Key to the Varieties of *Dalea pogonathera*

1. Longest calyx-tooth 4 mm long or more; *spikes* of calyces relatively broad, mostly 13–20 mm wide (pressed); *orifice* and teeth of calyx long-plumose, the hairs mostly 1.5+ mm long; *range* upland and western, from trans-Pecos Texas to Arizona, n.-w. Sonora, n. Zacatecas, and s. over most of Coahuila to w.-centr. Nuevo León, descending the Rio Grande in Texas and Coahuila into the range of the following. 147a. var. *pogonathera*.

1. Longest calyx-tooth less than 4 mm; *spikes* of calyces narrower, mostly 9–12.5 mm wide; *orifice* and teeth of calyx short-plumose, the hairs commonly $<$ 1.5 mm long; *range* lowland and eastern, on the Gulf Coastal Plain of Texas and adjoining Nuevo León and Tamaulipas, in Texas extending w. with decreasing frequency onto Edwards Plateau. 147b. var. *walkerae*.

147a. DALEA POGONATHERA Gray var. POGONATHERA

(Plate CXXXIII)

Relatively robust and large-flowered; *stems* 1–3.5 dm long; *leaves* 1–2 (2.5) cm long; *spikes* 13–18 (20) mm diam, the axis (1) 1.5–8 cm long; *bracts* 4–6 mm long, (3) 3.6–4.8 mm wide; *keel* (5.5) 5.8–6.8 mm long, the claws 1.1–1.8 (2.4) mm, the blades 4.3–5.8 mm long, 2.3–3.1 mm wide; $2n = 7_{II}$; 14 (Mosquin); $n = 7$ (Spellenberg, 1973). — Collections: 110 (vii).

Low hills and plains, mostly in the Larrea and Prosopis belts, strongly but not exclusively calciphile, widespread and common between 630 and 1800 (1890) m (2100–6300 ft) over the Chihuahuan Desert, from s. New Mexico (Grant, Luna, Doña Ana, Eddy cos) and trans-Pecos Texas through the e. half of Chihuahua and the whole of Coahuila into n. Zacatecas, just into w.-centr. Nuevo León, the Nazas basin in Durango, and possibly n. San Luis Potosí, in Durango passing the Divide to the head of Río Mezquital (mpo Nombre de Dios), in Texas extending e. of the Pecos to the n.-w. margins of Edwards Plateau (to Howard and Runnels cos) and downstream along Rio Grande to apparently disjunct stations, below 200 m, in Webb and Starr counties, there intergrading with var. *walkerae*; also from New Mexico w., still locally abundant, around the s. end of the Mogollon Mountains into the Gila Basin in s.-e. Arizona (to Graham, s.-e. Pinal, Pima, and Santa Cruz cos) and the n.-e. corner of Sonora (mpo Fronteras). — Flowering April to November, responding readily to rain. — *Representative*: UNITED STATES. ARIZONA: *Waterfall 12,899* (OKLA); *Thornber 205* (NY, UC); *Maguire 10,765* (NY), *10,990* (NY, UC). NEW MEXICO: *Metcalfe 1295* (NY, UC, US); *Wooton 415* (NY, UC); *Barneby 2481, 4201* (NY). TEXAS: *Wright 132 in 1849* (NY, OXF); *T. & L. Mosquin 5694* (NY); *Hinckley 1362* (NY); *McCart 7392, 7860* (OKLA). MEXICO. SONORA: *Wiggins 11,766* (DS). CHIHUAHUA: *Pringle 997* (F, NY, UC); *Mosquin et al. 6570* (NY); *Waterfall 16,120* (NY, OKLA); *Ripley & Barneby 13,857* (CAS, NY), *13,907* (NY). COAHUILA: *Palmer 146 in 1898* (F, NY, UC); *Wynd & Mueller 102* (ARIZ, NY); *Purpus 1065* (NY, UC); *I. Johnston 8230, 9413* (GH). NUEVO LEÓN: *Ripley & Barneby 13,259* (NY). DURANGO: *Correll & Johnston 19,985* (RENNER); *Mosquin et al. 6870, 6901* (NY); *Ripley & Barneby 13,476*. ZACATECAS: *Kirkwood 151* (F, GH). SAN LUIS POTOSÍ: *Parry & Palmer 163* (NY), this without precise station.

Dalea pogonathera (with bearded awns, of the plumose calyx-teeth) Gray, Mem. Amer. Acad. II, **4** (Pl. Fendl. **1**): 31. 1849. — "About Monterey, Mexico, *Dr. Edwards* and *Major*

Eaton. — Holotypus, *Edwards & Eaton 18*, GH! isotypus, NY! — *Parosela pogonathera* (Gray) Vail, Trans. N. Y. Acad. Sci. **14**: 34. 1894; A. Heller, Contrib. Herb. Franklin & Marshall Coll. **1**: 49. 1895 (as comb. nov.).

A modest but attractive plant, very common over the desert hills and plains of interior northern Mexico and adjoining United States westward from the Big Bend country, locally abundant especially on hard-packed, fine-grained soils derived from limestones. Except where sympatric with *D. lasiathera*, it is easily recognized by the syndrome of few (usually 2–3) pairs of narrow glaucous leaflets prominently dotted beneath, rather loose spikes of violet flowers, and particularly by the persistent, pale-margined, dorsally glabrous but verruculose bracts of broad outline that clasp and enfold the long-toothed, silvery-plumose calyces. As mentioned above, var. *pogonathera* passes eastward insensibly into var. *walkerae*, but has been collected in typical form on low limestone hills near the lower Rio Grande in Webb and Starr counties, Texas, a dispersal-pattern repeated by *D. nana* var. *carnescens*, with which it is commonly associated over a great part of its range.

147b. Dalea pogonathera Gray var. walkerae (Tharp & Barkley) B. L. Turner

(Plate CXXXIII)

Relatively slender and small-flowered; *stems* (0.4) 0.7–2 (2.5) dm long; *leaves* (0.4) 0.8–1.8 cm long; *spikes* 9–12 (13) mm diam, the axis 1–4 (5) cm long; *bracts* 3–4.5 mm long, 3.2–4.6 mm wide; *keel* 4.2–5.7 mm, the claws 0.8–1.3 mm, the blades 3.4–4.8 mm long, 1.9–2.7 mm wide; 2n = 14 (Mosquin). — Collections: 71 (viii).

Plains, low hills, beaches, common and locally abundant on sandy clays, below 180 m (600 ft), of the Gulf Coastal Plain of s. Texas and lower Rio Grande valley downstream from Eagle Pass, s. through neighboring Coahuila and n. Tamaulipas to the first bench of Sierra Madre Oriental in n. Nuevo León, n.-w. in scattered stations (perhaps partly introduced along highways) up to 800 m onto the limestones of Edwards Plateau (to Taylor and Reagan cos), and s.-w., up to 1700 m, into centr. San Luis Potosí. — Flowering February to December, perhaps all year near the Gulf coast. — *Representative*: UNITED STATES. Texas: *E. J. Palmer 11,291* (NY, UC); *Tracy 9077* (NY, WIS); *A. Heller 1482* (NY); *Ripley & Barneby 13,245* (NY), *14,507* (NY, US); *Barneby 14,485* (DAO, NY); *Correll & Johnston 17,887* (RENNER). MEXICO. Coahuila: *Pringle 912* (F). Tamaulipas: *Palmer 381* (F, UC); *Ripley & Barneby 13,597* (NY); *Tracy 9078* (F, NY, W). Nuevo León: *Palmer 219 in 1880* (F, NY); *Pringle 13,727* (ARIZ, F, L, OKLA, UC); *Ripley & Barneby 14,783* (NY). San Luis Potosí: *Chiang et al. 8217C* (NY).

Dalea pogonathera Gray var. **walkerae** (Tharp & Barkl.) B. L. Turner, Field & Lab. **24**: 16. 1956, based on *Parosela walkerae* (Thelma Ratcliffe Walker, 1908–) Tharp & Barkl., Bull. Torrey Club **73**: 133. 1946. — "Type: La Joya, Hildalgo [sic] County,]Texas], February 2, 1942, *Mrs. E. J. Walker s. n.*...." — Holotypus (*Walker 24*), TEX! isotypus, GH!

Dalea penicillata Moric., Pl. Nouv. d'Amér. 66, minore pro parte, Tab. XLV, fig. 2. 1839. — "Habitat in Texas...*Berlandier...2023*." — Only the paratypus cited above, G! the holotypus (*Berlandier 1747*) = *D. enneandra*.

The extreme form of var. *walkerae* differs substantially from the average var. *pogonathera* in its slender growth, and in the narrow spikes of short-toothed calyces. The petals are usually smaller, and often of a paler violet. In Webb, Starr, and Zapata counties, Texas, the two varieties are found close together, but I have seen only one or two mixed collec-

tions (*Correll & Johnston 18,115*, RENNER). The main range of var. *walkerae* lies out on the sandy plains below Balcones Escarpment, but is has been found occasionally west of that line and at its southern limit in Nuevo León again climbs onto the calcarous piedmont, and gradually loses its distinctive facies. A specimen of var. *walkerae* was collected by Karwinski as early as 1827 (*No. 5755*, M), 120 years before the entity received a name.

148. DALEA LASIATHERA Gray
(Plate CXXXIII)

Herbs (resembling the last) from a tough yellow root and shortly forking caudex, glabrous to the calyces, the decumbent or incurved-ascending, pallid, striate, sparsely low-pustulate stems 1–3 (3.5) dm long, simple or with 1–2 lateral monocephalous branches beyond the middle, the foliage glaucous or glaucescent, the thick-textured leaflets pale blue-green above, pustulate-punctate beneath; *leaf-spurs* up to 0.5 mm long; *stipules* narrowly subulate-attenuate, brown or livid, 0.8–2.2 mm long, the broader ones with narrow scarious margins; *intrapetiolular glands* 0; *post-petiolular glands* prominent, either obtuse or crateriform; *leaves* shortly petioled or subsessile, (1) 1.5–3 cm long, with thick-margined, punctate rachis and (2) 3–5 pairs of linear-oblanceolate, -elliptic, or narrowly oblong-oblanceolate, emarginate or obtuse, loosely folded or marginally elevated leaflets 5–12 mm long; *peduncles* terminal, 1.5–5 (6) cm long; *spikes* moderately dense, the flowers (pressed) mostly 2–3-ranked and not concealing the glabrous axis, without petals and androecia 11–13 mm diam, becoming 2–6 cm long; *bracts* persistent, glabrous, broadly ovate from a subtruncate base, abruptly short-acuminate, folded to embrace the calyx, (3) 3.5–5.5 mm long, 3.8–5 mm wide, the firm body glaucescent and grossly glandular-pustulate dorsally, carinate, the margins scarious, pallid, sometimes undulate; *calyx* 5.3–6.9 mm long, silky-pilosulous with ascending and subappressed hairs up to 0.55–1 mm long, the oblique orifice and base of teeth very densely pilosulous-ciliate, the broadly campanulate tube 3.3–3.9 mm long, 3.1–3.7 mm diam, the ribs becoming prominent, the rather firm intervals charged with 1 (or the ventral pair with 2) rows of 3–5 (8) pallid glands mostly concealed by vesture, the teeth deltate and abruptly contracted into a subulate point, the longest 1.9–2.8 (3.2) mm long, 0.5–1.8 mm shorter than tube, their lateral nerves intramarginal, forking below the membranous sinuses; *petals* bright violet- or magenta-purple, the banner with a yellow, early rubescent, gland-sprinkled eye, the epistemonous ones perched near middle of androecium; *banner* 6.2–7.5 mm long, the claw (2.5) 3–4 mm, the quadrate-ovate, basally cordate, emarginate blade recessed above top of claw into a cornet, 3.8–4.6 mm long, 4.2–5 mm wide; *wings* 4.5–6.2 mm long, the claw (2.5) 3–4 mm, the obovate or oblong-obovate blade 3.7 –4.7 mm long, 2.2–3 mm wide; *keel* (6.3) 6.6–9.4 mm long, the claws 1.5–2.4 (3.6) mm, the oblong-elliptic blades 5.3–6.5 mm long, 2.3–3.7 mm wide; *androecium* 10-merous, 8.5–12 mm long, the longer filaments free for 3.4–4.7 mm, the connective minutely gland-tipped, the anthers 0.8–1.2 mm long; *style* (? always) exserted at full anthesis; *pod* 3–3.5 mm long, the prow bicarinate; *seed* brown, smooth, ± 2.3 mm long.— Collections: 57 (ii).

Stony plains and hillsides, commonly on limestone, coming out s.-e.-ward into mesquite-savanna, mostly 160–1550 m (530–5170 ft), rather common and locally plentiful on Edwards Plateau, Texas, and the calcareous ranges of the n.-e. half of Coahuila, in Texas crossing the Colorado R. into Brown and Taylor counties, w. to Crockett and s. to Uvalde County, with outlying stations in trans-Pecos (Jeff Davis

and n. Presidio cos), extending briefly out onto the plains of Rio Grande (Bravo) valley, in Texas to La Salle County, in Mexico to the n.-e. corner of Coahuila, apparently somewhat isolated, at ± 600 m, on the e. piedmont of Sierra Madre Oriental in centr. Nuevo León (mpo Allende), and disjunct at sea-level on the Gulf Coast of Tamaulipas near Laguna Madre. — Flowering late March to June, sometimes again in September to November. — *Representative*: UNITED STATES. TEXAS: *Cory 51,718* (NY, UC), *52,024* (NY); *T. & L. Mosquin 5629* (NY); *Tolstead 7141* (OKLA, TEX, UC); *D. & H. Corell 30,454* (RENNER); *Small & Wherry 11,952* (NY, RENNER). MEXICO. COAHUILA: *Stewart 1346* (GH, TEX); *Marsh 1149, 2150* (F, GH, OKLA); *Pringle 9029* (F, MEXU); *Ripley & Barneby 14,219* (CAS, NY); *I. Johnston 9122* (GH). NUEVO LEÓN: *C. & M. Mueller 496* (F, TEX); *Palmer 224 in 1880* (NY). TAMAULIPAS: *LeSueur 219* (ARIZ, F, TEX); *González Medrano s. n. in 1963* (ENCB).

Dalea lasiathera (with woolly awns, of the calyx-teeth) Gray, Pl. Wright. **1**: 48. 1852. — "133...Prairies, west of San Antonio, Texas, and valley of the Limpia." — Holotypus, collected by Charles Wright in 1849, GH! isotypi, NY, OXF, UC, US! — *Parosela lasiathera* (Gray) A. Heller, Cat. N. Amer. Pl. ed 2, 6. 1900. *P. lasianthera* (sphalm.) Rydb., N. Amer. Fl. **24**: 96. 1920, an inadvertent, often copied error.

Similar to the large-flowered phase of the preceding species, *D. pogonathera* var. *pogonathera*, but easily distinguished by the deeply campanulate, short-toothed calyx clad in shorter, silky-pilosulous rather than plumosely spreading hairs. Though no taller than *D. pogonathera*, plants of *D. lasiathera* become, in their prime, more robust, with more numerous, leafier stems and showier spikes of flower. Leaflets in *D. pogonathera* are normally two or three pairs, but in *D. lasiathera* three, four, or five. The petals of *D. pogonathera* are violet-purple, and the banner has a small white or greenish-white eye glandless or almost so; in *D. lasiathera* the ground-color is commonly vivid magenta, the banner-eye yellow and garnished with little yellow oil-blisters. The partly sympatric *D. pogonathera* var. *walkerae* is an altogether more modest plant, the calyx-teeth as short, but combined with a short tube and smaller petals.

149. DALEA ENNEANDRA Nuttall
(Plate CXXXIV)

Erect perennial herbs from a tough yellow root, (5) 6–12 dm tall, glabrous up to the silky calyces, the stems solitary or few (seldom over 3), in lower ½–⅔ simple and (young) densely leafy, branching distally into a broadly rounded or flat-topped panicle of narrow flexuous spikes, the main axis commonly leafless by full anthesis, the branches only remotely and minutely gland-tuberculate or smooth, the stramineous branchlets terete, the foliage glaucous, the thick-textured leaflets smooth above, gland-dotted beneath; *leaf-spurs* 0.4–0.7 mm long; *stipules* narrowly triangular-subulate, livid, 0.6–1.3 mm long, becoming dry and fragile; *intrapetiolular glands* 0; *postpetiolular glands* prominent, orange or red; *leaves* subsessile, the main cauline ones 1.3–2.6 cm long, with narrowly thick-margined punctate rachis and (2) 3–5 (6) pairs of narrowly oblanceolate or elliptic, obtuse, navicular or loosely folded, bluntly gland-mucronulate leaflets 4–11 (12) mm long, the leaves reduced upward along the finer branchlets, with only (1) 2–3 pairs of smaller leaflets; *peduncles* mostly terminal to ultimate branchlets of the panicle, but a few early ones appearing leaf-opposed, 0.5–3.5 (5.5) cm long; *spikes* loosely or remotely (2) 5–30 (35)-flowered, the flowers (pressed) ± 2-ranked, revealing the glabrous axis, this at length (1) 2.5–12 cm long;

bracts persistent, broadly ovate, obovate, or obovate-truncate, folded around the calyx, carinate dorsally, the keel running out into a reddish mucro not over 1 mm long, the body 3–4.2 mm long, in profile 1.6–2.5 mm wide, except for the broad pallidly membranous sometimes ciliolate margin firm, glabrous, glaucescent, and charged with many small but prominent orange or livid blister-glands; *calyx* 6.2–7.6 mm long, silky-pilosulous with ascending spiral hairs up to 1.1–1.7 mm long, the tube 3–3.5 (3.7) mm long, the slender, concolorous ribs not very prominent, the membranous intervals charged with 1 row of 3–4 small transparent glands (invisible from without), the orifice oblique, the triangular-aristate, reddish, commonly gland-spurred teeth subequal, (3.3) 3.5–4.6 mm long, at length stellately divergent and plumose; *petals* white, glandless, or the banner rarely with a small subapical gland and 1–2 small glands in the 2-lobed, greenish eye, the epistemonous ones perched below middle of androecium, (2) 2.2–4 mm above hypanthium; *banner* 5.7–7 mm long, the subterete claw (2.5) 2.7–3.5 mm, the ovate-spade-shaped blade 3.6–4 mm long, 3.2–4.2 mm wide, open at base but recessed down the claw into a shallow cornet; *wings* 2.8–4.1 mm long, the claw 0.4–1.2 mm, the obliquely ovate blade 2.7–3.4 mm long, 1.4–2 mm wide, its large basal auricle often as long as claw; *keel* 5.4–7 mm long, the claws 1–1.9 mm, the obliquely elliptic or half-elliptic blades (4.5) 4.8–5.8 mm long, 2.6–3 mm wide; *androecium* 9-merous, 6.3–9.4 mm long, the longer filaments free for 2.2–3.5 mm, the connective gland-tipped, the anthers 0.85–1.15 mm long; *pod* obliquely triangular-obovoid, 3–3.7 mm long, the ventral suture prominently pored, the prow dilated, the valves hyaline in lower ½, thence papery, glandless or minutely gland-sprinkled, barbate distally; *seed* 2.4–2.8 mm long; 2n = 14 (Mosquin). — Collections: 161 (vii).

Plains and prairies, 30–1320 m (100–4400 ft), on a variety of sedimentary and alluvial soils but perhaps most vigorous on limestone, n.- and w.-ward mostly on bluffs, breaks, and badlands following streams and rivers, common and locally abundant from e.-centr. and n.-w. Texas, from the n. margin of Edwards Plateau, n. through the western ¾ of Oklahoma and Kansas, thence more scattered and becoming rarer to the southern ⅓ of North Dakota, w. sparingly to the w. slope of the Black Hills in Wyoming, to w. Nebraska, extreme e. Colorado, the upper forks of the Canadian in n.-e. New Mexico and, apparently disjunctly, middle trans-Pecos Texas, e. to the bluffs of Missouri River from n.-w. Iowa downstream to n.-w. Missouri, in Texas e. to upper and middle Trinity River, s. to Balcones Escarpment, and along the lower Brazos River feebly out onto the Gulf Coastal Plain (Fort Bend Co.). — Flowering late June to September. — *Representative*: WYOMING: *Degener & Peiler 16,018* (NY, OKLA). NORTH DAKOTA: *O. A. Stevens 381* (UC, WIS), *1389* (NY, UC). SOUTH DAKOTA: *Rydberg 607* (NY); *G. N. & F. F. Jones 14,898* (NY). NEBRASKA: *Rydberg 55, 5956* (NY); *Tolstead 41,1052* (UC). IOWA: *Gleason 9304* (NY, WIS); *Thorne 14,675* (UC). COLORADO: *W. A. Weber 4321* (UC), *12,961* (NY, WIS); *Osterhout 4035* (NY, WIS). KANSAS: *Rydberg & Imler 618, 705* (NY); *Barneby 13,808* (DAO, NY); *Welsh 669* (NY). MISSOURI: *Gleason 9277* (NY, WIS); *Bush 220, 9183* (NY). NEW MEXICO: *Barneby 13,813* (NY). OKLAHOMA: *Demaree 13,109* (NY, UC); *Waterfall 1407, 6812* (NY). TEXAS: *Reverchon 227* (NY, OKLA, UC); *Mueller 8550* (NY, OKLA); *Ruth 970* (NY, WIS); *Lindheimer 757* (MO, NY, UC); *Warnock 8013* (OKLA, RENNER).

Dalea enneandra (with 9 stamens) Nutt. in Frasers' Cat., No. 30. 1813, reprinted by Greene, Pittonia **2**: 116. 1890. — "...in Upper Louisiana, and principally on the River Missourie." — No typus examined, but long identified with the next following, *D. laxiflora*,

for which it is the earlier name. — *Parosela enneandra* (Nutt.) Britt., Mem. Torrey Club **5**: 196. 1894.

Dalea laxiflora (loosely flowered) Pursh, Fl. Amer. Sept. 741. 1814, nom. illegit., the earlier *D. enneandra* cited in synonymy. — "*In* Upper Louisiana. Bradbury...v. s. in Herb. Bradbury." — Isotypus (fragm.), ex herb. Lambert., NY (herb. Torr.)! — *Psoralea laxiflora* (Pursh) Poir. in Lamk., Encycl. Suppl. **4**: 590. 1816. *Petalostemon laxiflorum* (Pursh) Steud., Nom. Bot., ed. 2, **2**: 308. 1841.

Cylipogon virgatum (wandlike) Raf., "Jour. Phys. Chim. Hist. Nat. **89**: 97. 1819", reprinted in Isis van Oken 1820, **1**: Lit. Anzug. 237. 1820. — "Haut-Missouri", *Bradbury*. — Listed here as a separate proposition, but probably based on and a mere substitute for *D. laxiflora* Pursh.

Dalea penicillata (brushlike, of the plumose calyx-teeth) Moric., Pl. Nouv. d'Amér. 66, majore pro parte, Tab. XLV, fig. 1. 1839. — "Hab. in Texas. Inter Rio della Trinidad et Bexar, legit Berlandier. No. 1747, 2023." — Lectotypus, *Berlandier 1747*, collected in bud in June 1828, G! isotypus, OXF! paratypus, *Berlandier 2023* (G) = *D. pogonathera* var. *walkerae*.

Dalea laxiflora var. *pumila* (lowly) Shinners, Field & Lab. **21**: 164. 1953. — "TYPE: 2.4 miles west of Midlothian, Ellis Co., Texas, *V. L. Cory 53337*, July 2, 1946..." — Holotypus (SMU) not examined; isotypus, UC! paratypus, *Whitehouse 10,515*, NY! — *Dalea enneandra* var. *pumila* (Shinners) B. L. Turner, Leg. Tex. 153. 1959.

A plant of strongly idiosyncratic facies, almost never misidentified, in habit recalling some subtropical marinas, but no compatriot dalea. The primary stems, often solitary and seldom more than three from any root, are at first densely leafy. With the beginning of hot summer weather, as the first inflorescences come into flower, the cauline leaves begin to dry up and drop off, leaving a naked wand to bear aloft the indefinitely ramified, thinly leafy panicle of spikes. The small and ephemeral white petals are less seen than the silvery cup that holds them. As the fruit ripens, the pod and calyx, still wrapped at base in its dotted bract but with plumose teeth now stellately spread, disjoint as a unit and sail forth wind-borne on a five-rayed pappus. Despite its distinct appearence, the affinity of *D. enneandra* to *D. pogonathera*, also sometimes 9-androus, is obvious and never disputed. Common characters are the similar individual leaf, the broad, persistent, membranous-margined bract enclosing a similar long-toothed calyx, and the pod's curiously dilated prow.

The species varies little except in stature. Shinners described as var. *pumila* a form, thought to replace the typical one in a small section of east-central Texas (e. of East Cross Timbers), distinguished by a short primary stem-axis and densely doming panicle. It was accepted by Turner (1959) but similar forms 5–6 dm tall (cf. *Ripley & Barneby 7244*; *J. B. Norton 91*; both NY) occur in Kansas.

The protologue of *D. penicillata* was based on two collections, one (in bud) representing *D. enneandra*, the other (at anthesis) *D. pogonathera* var. *walkerae*. Technically the name might be interpreted in either sense, but in order to preserve the well-known *D. pogonathera* Gray, junior to *D. penicillata* by ten years, I have designated as holotypus the *D. enneandra* element.

IVD (ii). Series CITRIODORAE (Rydberg) Barneby

Obligately monocarpic (but sometimes tall and dried specimens not obviously so); *foliage* green, the leaflets of main cauline leaves mostly 9–17 pairs; *bracts* early deciduous, the ovate to obcordate, broadly hyaline-margined body abruptly contracted into a short tail; *petals* dull pink to bright purple, sometimes blue, the banner sometimes partly white; *prow* of pod corneous, flat. — Sp. 1, polymorphic, widely dispersed in temperate and arid-tropical Mexico and Central America, apparently naturalized in n. South America.

Dalea subgen. **Parosela** sect. **Psoropogon** ser. **Citriodorae** (Rydb.) Barneby, comb. nov., based on *Parosela* subgen. *Euparosela* XVI. *Citriodorae* Rydb., N. Amer. Fl. **24**: 80. 1920. – Sp. typica: *P. citriodora* = (syn. tax.) **Dalea foliolosa** (Ait.) Barneby.

A monotypic series, important because of the abundance and wide dispersal of the individual plants, the *Citriodorae* can be recognized in the field by the following syndrome: annual root; glabrous foliage, the leaves with numerous (7–17 pairs) of small, usually thick-textured leaflets; broad, hyaline-margined bracts deciduous from under the expanding flower-bud; a broad prow to the pod. Herbarium specimens of the often tall *D. foliolosa* var. *citrina* seldom show the nature of the root and because of the many leaflets and paniculate inflorescence are likely to be sought in sect. *Parosela* especially among the *Pectinatae*. The characteristic bracts should suffice to identify flowering material, the pod's dilated prow any material that has lost all its bracts. All other annual daleas with glabrous foliage have either fewer leaflets, or keel-petals imbricate to free, or a pod with filiform sutures, or some combination of these characters.

150. Dalea foliolosa (Aiton) Barneby
(Plate CXXXV)

Annual herbs, variable in stature and habit, (0.5) 1–10 (12) dm tall, glabrous below the inflorescence, either branching from the base, the stems then diffuse and assurgent, or simple and paniculately branching from near or well above the middle, the stems reddish or stramineous, smooth or commonly sparsely verruculose distally, the foliage green, the leaflets smooth above, usually punctate dorsally and marginally but the glands sometimes obscure or lacking; *leaf-spurs* very short; *intrapetiolular glands* small, sometimes impressed or obscure; *post-petiolular glands* prominent; *main cauline leaves* 1–8 cm long, subsessile or shortly petioled, the rachis narrowly thick-margined, usually punctate, the leaflets (5) 7–17 pairs, elliptic, oblong-obovate, or oblanceolate, obtuse, obtuse and gland-mucronate, or rarely acutish, flat or boat-shaped but not strongly folded, (1) 1.5–8 mm long; *peduncles* both terminal and leaf-opposed, slender but stiff, commonly erect, (1) 1.5–12 (16) cm long; *spikes* moderately dense, the calyces at anthesis subcontiguous but not compacted into a conelike head, at first ovoid to shortly oblong becoming oblong to cylindric, without petals 6–11 mm diam, the hispidulous axis becoming (4) 6–30 cm long, the lowest flowers declined or deflexed in fruit; *bracts* completely enveloping the young flower-buds but early thrown off, glabrous within and without, the circular or very broadly ovate, ovate-elliptic, flabellate, or obcordate body (1.7) 2–3.3 mm long, membranous at base and broadly hyaline-margined, sparsely glandular-verruculose dorsally, abruptly contracted into a subulate tail from ¼ to nearly as long; *calyx* 2.9–6.7 mm long, sessile or elevated on an obscure pedicel up to 0.3 mm long, densely silky-pilosulous externally, the tube 1.9–2.7 mm long, not recessed behind the banner, the slender ribs usually livid, becoming prominent in age, the membranous intervals glandless or charged with one vertical row of ± 3–5 small, transparent or pale yellow glands, the teeth varying from deltate to deltate and long-aristate, the dorsal one 0.7–4.3 mm long, varying from much shorter to nearly twice as long as the tube; *petals* variable in color, the banner usually opening white in part (the tip and basal lobes variably colored) but rubescent in age, the inner petals (elevated ± 0.7–1.4 mm from hypanthium rim) dull rose-pink to bright reddish-purple, magenta-purple, or vivid violet, usually all eglandular but sometimes gland-tipped; *banner* 2.7–4.5 mm long, the claw 1.2–2.8 mm, the broadly deltate- or hastate-ovate blade thickened at base but obscurely if at all recessed into a cornet, 1.3–2.8 mm long; *wings* 2.3–4.6 mm long, the claw 0.5–1.7 mm, the oblong-elliptic blade 1.6–3.5 mm long, 0.7–1.8 mm wide; *keel* 2.8–4.8

mm long, the claws 0.7–1.9 mm, the obliquely obovate to elliptic blades 2–3.5 mm long, 1.6–2.1 mm wide, united by their exterior edges; *androecium* (9) 10-merous, 3–4.8 mm long, the longest filament free for ± 1 mm, the connective gland-tipped, the anthers 0.2–0.4 mm long; *pod* obovoid-truncate, compressed, 2–2.6 mm long, slenderly crested dorsally, the ventral suture subfiliform but the prow greatly thickened, the style-base latero-terminal, the valves hyaline in the lower half, thence thinly papery, pilosulous, eglandular; *seed* (1.4) 1.6–2 mm long; 2n = 14.

The toronjil, so called in Guatemala and southern Mexico because of the penetrating smell of lemon-blam (*Melissa*) exhaled by the crushed leaves, is second only to *D. leporina* the most widely dispersed annual dalea of the plateau, temperate highlands, and interior subtropical valleys of Mexico, extending from Chihuahua and southern Coahuila to Chiapas, and thence on through mountainous Guatemala into Honduras, reappearing locally, probably as an alien, in Venezuela and Colombia. It is distinguished from other annual daleas with glabrous foliage and silky spikes by the suborbicular, hyaline-margined bracts which envelop the flower buds but are thrown off as the corolla begins to expand, and by the wide, bluntly thickened prow of the pod. As interpreted here, *D. foliolosa* is polymorphic and composed of numerous geographic races, collectively equivalent in scope to *Parosela* XVI. *Citriodorae* of Rydberg (1920, pp. 80–81), who recognized five species within the group. Variable features of *D. foliolosa* sens. lat. which seem to serve taxonomic purposes are the average stature of a population, the mode of branching, the length of the calyx-teeth, and color of the inner petals. The type encountered almost exclusively on the Mexican plateau, northward from the Valley of Mexico, is a low, slender plant with several diffuse stems (up to ± 3 dm) from the root-crown, calyx-teeth deltate and tipped with a small callous point, and petals opening dull rose-color and drying purplish or purplish-brown. This is the original *Psoralea foliolosa* of Aiton and probably also the plant sent by Sessé from Mexico as *Psoralea citrodora* and grown in the Madrid garden, the *Psoralea citriodora* of Cavanilles. In the valleys of the Lerma-Santiago and Balsas rivers, mostly below 1800 m (6000 ft), *D. foliolosa* is represented by a series of taller types, characteristically erect and monopodial, up to a meter tall, and paniculately branching beyond the middle into a flat-topped or broadly rounded panicle. Generally associated with increased stature one finds the calyx-teeth drawn out (the dorsal one especially) into a stiff, aristate spinule, and inner petals blue- or violet-purple drying blue. Here belong *Parosela vernicia* and *P. citrina* of Rydberg, which were separated on trivial and obviously variable characters involving shape of the leaflet-apex and length of the bracts' acuminate tail. Easily separated in its extreme form from typical *D. foliolosa* this tall lowland form extends north discontinuously along the east slope of the plateau from Puebla to southern Tamaulipas (Jaumave), and reappears in central Oaxaca, in Chiapas, at 200–480 m in the Zacapa desert in Guatemala, and as a weed in northern South America. Unfortunately, however, numerous collections do not fit neatly into either category. When much material is brought together, the mucro on the teeth of typical *D. foliolosa* can be seen to elongate by tiny successive steps into a spinule of the sort designated below as the chief diagnostic feature of var. *citrina*. The monopodial, distally branching growth-form sometimes occurs in short-calyxed plants as little as 1 dm tall. And occasional populations include individuals with dull rose petals among the lively purples. The picture of variation is further complicated by the existence in southeastern Mexico, Guatemala, and Honduras, mostly at montane levels, of a form in which the short-toothed calyx of the Plateau var. *foliolosa* is combined with diffuse growth-habit and bright violet flowers of a hue matched at lower elevations in the same region by typical var. *citrina*. This southern type, which I interpret as a geographic variant of var. *foliolosa* too poorly marked to deserve nomenclatural status, has been described as *Parosela roseola* Rydb. and probably also, much earlier, as *D. platystegia* Schauer. It is often intuitively recognizable, but when studied in detail is found to possess no one technical character which does not occur (even though much less often) in what is believed to be typical var. *foliolosa* of the Meseta Central.

As I have seen *D. foliolosa* in all its major zones of occurrence northward from central Oaxaca, I have repeatedly noted the weedy nature of the plants. Toward the north edge of the specific range, perhaps everywhere north of the Tropic line, var. *foliolosa* is found usually as a roadside ruderal, and even in central Mexico it tends to be more abundant along highways, or as a weed of cornfields, than in relatively undisturbed land. The var. *citrina* behaves as a native on malpais and in thorn-scrub in the Balsas basin, but also here and there forms massive roadside stands where the plants grow so thickly as to exclude all rivals. The records of var. *citrina* from South America are scattered and situated near centers of colonial Spanish settlements; it is reasonably certain that it is here introduced from Mexico, but naturalized, for it has been met with in Colombia from mix-XIX century up to modern times. The southern form of var. *foliolosa* appeared to me to be native in the pine-oak forest of Mixteca Alta, but is found also, possibly as an immigrant from higher elevations in the surrounding mountains, in the vale of Oaxaca.

Granted the weedy propensities of *D. foliolosa* sens. lat., one should not be surprised to find within the species a disturbed racial situation reflecting the disturbance of its habitat and the fragmentation of the aboriginal (or "natural") patterns of dispersal. Nothing is known of the possibilities of introgression between races of *D. foliolosa* which might be brought into contact; some populations seen in the field, members of which varied in stature and in petal-color more than is normal in the majority of *Dalea* species, suggest Mendelian segregation of characters derived from var. *foliolosa* crossed with var. *citrina*. These, however, do not account for the full ranges of variation which seem now to link the extreme forms of the species into a continuous network. The taxonomic division of *D. foliolosa* into two varieties, proposed here, hinges on an arbitrary point of 1.35 mm in length of calyx-teeth as the critical differential character. No other phenetic character can be relied on as an index of racial differences.

Key to the Varieties of *Dalea foliolosa*

1. Calyx-teeth deltate or deltate-apiculate, the longest (dorsal) one 0.7–1.3 mm long; *stems* as a rule relatively short, (0.5) 1–5 (6) dm long, either branching from near the root-crown and diffuse, or erect and branching distally (seldom erect and simple up to the distal panicle); *petals* variable in color, but northward from Transverse Volcanic Belt usually roseate drying dull purple, bright blue or violet southeastward from the Balsas Depression; plants typically of arid plateau or (southward) of temperate montane habitats mostly between 1600 and 2400 m. 150a. var. *foliolosa*.

1. Calyx-teeth deltate at base but prolonged into a developed mucro or aristiform point, the longest (dorsal) one 1.4–4.3 mm long; *stems* on average taller, (3) 4–10 dm long, typically solitary and erect from the root, paniculately branching from near or well above the middle; *petals* nearly always vivid purple or blue-purple drying blue; plants of arid subtropical brush and thorn-forest, between 200 and 1700 m, rarely higher. 150b. var. *citrina*.

150a. DALEA FOLIOLOSA (Aiton) Barneby var. FOLIOLOSA

(Plate CXXXV)

Characters as given in key; n = 7_{II} (Spellenberg, 1973, as *foliosa*). — Collections: 108 (xv).

Dry, often weedy places, becoming colonial along highways, in fields, in disturbed and over-grazed brushland, on a variety of volcanic and sedimentary substrata, mostly 1550–2500 m (± 5200–8300 ft), widespread and locally abundant over much of the

Mexican Plateau from n.-e. and centr. Chihuahua to s. Coahuila, interior Jalisco, n. Michoacán, the Valley of Mexico, and Puebla; absent from the lowlands of the Bajio Country and the Balsas Depression, but again locally plentiful in the temperate highlands of Sierra Madre del Sur and centr. Oaxaca s.-e. through Chiapas and Guatemala into Honduras, in its s. province apparently native in pine-oak woodlands up to 2175 m (7250 ft), but descending along paths, highways, and margins of cornfields into arid grasslands as low as 1000 (exceptionally 550) m. — Flowering June to November n.-ward, mostly September into early winter s.-ward. — *Representative*: MEXICO. CHIHUAHUA: *R. M. Stewart 2361* (GH); *Ripley & Barneby 13,869* (CAS, NY). DURANGO: *Palmer 619* (ARIZ, C, F, NY, UC). COAHUILA: *Ripley & Barneby 13,802* (NY). ZACATECAS: *Pringle 1777* (BR, F, M, NY, UC, W). AGUAS CALIENTES: *Rose & Painter 7701* (NY, US). SAN LUIS POTOSÍ: *Ripley & Barneby 13,324* (CAS, MEXU, MICH, NY, US). JALISCO: *McVaugh 13,258* (MEXU, MICH). MICHOACÁN: *Seler & Seler 1212* (US); *Ripley & Barneby 13,397a* (NY, from near Zitácuaro, where associated with var. *citrina*). MÉXICO: *Miranda & Barkley in 1946* (ENCB, F); *Bourgeau 775* (BR, F, L, M, P); *Pringle 9739* (F, L, NY, Z). PUEBLA: *Purpus 2650* (F, NY). VERACRUZ (?): *Mueller 282* (NY, perhaps from adjoining Puebla). GUERRERO: *Hinton 14,822* (GH, NY, RENNER, UC, US). OAXACA: *Liebmann 4584* (F, UC, W); *Ripley & Barneby 14,592* (CAS, MEXU, NY, US), *14,609* (NY), *14,642a* (CAS, NY). CHIAPAS: *Breedlove 7893* (ENCB, NY), *13,056* (NY), *14,142* (US). GUATEMALA. HUEHUETENANGO: *Standley 81,308* (F). SACATEPÉQUEZ: *Standley 59,443* (F). CHIMALTENANGO: *Standley 62,788* (F). GUATEMALA: *Aguilar 14* (F). ESCUINTLA: *Standley 58,197* (F). JALAPA: *Standley 77,278* (F). JUTIAPA: *Steyermark 30,389* (F). HONDURAS. COMAYAGUA: *Scherz, s.n.* (W).

Dalea foliolosa (Ait.) Barneby, Phytologia **26**: 1. 1973, based on *Psoralea foliolosa* (with little leaflets) Ait., Hort. Kew. **3**: 82. 1789. — "Introd. 1780, by Benjamin Bewick Esq." — Holotypus, so labelled, BM!

Psoralea citriodora (lemon-scented, of the foliage) Cav., Ic. **3**: 36, Pl. 271. 1794. — "Habitat in Nova-Hispania...Florebat...in horto Matritensi...." — No typus found in herb. Cavanilles. (MA); neotypus, labelled "*Dalea citriodora*", Herb. Sessé & Mociño *2666* (p. p., the plants at left of sheet), MA! isotypus (fragm.), F! — *Dalea citriodora* (Cav.) Willd., Sp. Pl. **3**: 1339. 1801, comb. illegit. *Parosela citriodora* (Cav.) Rose, Contrib. U. S. Nat. Herb. **10**: 104. 1906.

Dalea polyphylla (with many leaves or leaflets) Mart. & Gal., Bull. Acad. Brux. **10**[2]: 44. 1843. — "...dans les bois de Juquila et de Yolotepeque (cordillère occidentale d'Oaxaca, près l'Océan pacifique), de 4 a 6,000 pieds..." — Holotypus, *Galeotti 3164*, BR (herb. Mart.)! isotypi, F (fragm), P, W! — *Parosela polyphylla* (Mart. & Gal.) Rose in Contrib. U. S. Nat. Herb. **10**: 104. 1906.

Dalea platystegia (with broad bracts) Schauer, Linnaea **20**: 741. 1847. — "In terris Mexicanis: *Aschenborn n.* 462." — Holotypus, formerly at B, destroyed; no isotypus found. — The description clearly indicates a form of *D. foliolosa*, the short, ovate teeth of the calyx pointing to var. *foliolosa* rather than var. *citrina*.

Psoralea citrodora (lemon-scented) Sessé & Mociño, Fl. Nov. Hisp. 120. 1889. — "Habitat in Chilapae montibus [Guerrero]. — Lectotypus, the same specimen (MA) as that of *Psoralea citriodora* Cav., q. v. supra.

Parosela roseola (pinkish) Rydb., N. Amer. Fl. **24**: 81. 1920. — "Type collected on Volcan Jumaytepeque, Guatemala, November 1892, *Heyde & Lux* (Donnell Smith dist. no.) *4166...*" — Holotypus, NY! isotypi, GH, US! — *Dalea roseola* (Rydb.) Cowan, Brittonia **8**: 60. 1954.

For comment on variation in var. *foliolosa* see discussion of the whole species, above. The synonymy deserves a word of explanation. The original description of *Ps. citriodora* Cav., nomenclatural parent of *Parosela* or *Dalea citriodora*, the names under which var. *foliolosa* has passed in modern times, was based on plants cultivated in Madrid from Mexican seed furnished by Sessé. Nothing matching the protologue or bearing the name was found in the Cavanilles herbarium (MA). On the other hand the Sessé & Mociño herbarium contains several sheets of var. *foliolosa*, associated with a variety of names, some obviously inappropriate and misplaced. One, however, is actually labelled "*citriodora*", and also agress well with the protologue of the independently published *Ps. citrodora* S. & M. It seems reasonable to suppose that the epithet *citriodora*, descriptive and unusual, was coined for *D. foliolosa* by the field-botanist Sessé and later taken up by Cavanilles for the plant which flowered in cultivation. Following this line of reasoning, I have selected the same Sessé specimen as lectotypus of both proposals, thereby settling the two variant spellings as exactly synonymous. I must mention, nevertheless, one discrepancy. The lectotypus represents, I believe, the form of var. *foliolosa* found on the Mexican Plateau. However Sessé & Mociño quote as the locality for their *Ps. citrodora* the mountains of Chilapa, in Guerrero, a region where one would expect either the blue-flowered, southern variant of var. *foliolosa* or possibly, if from a valley habitat, the taller var. *citrina*. The latter was collected by the botanists of the Royal Expedition in New Spain (*Herb. Sessé and Mociño 2653*, MA, sub nom. *Ps. laevigata*), and it is therefore possible that this, and not var. *foliolosa*, was the type actually grown in the Madrid garden. It should be noted that this *Ps. laevigata* of the Sessé Herbarium cannot be the plant described under that name in Plantae Novae Hispaniae 120. 1889; the latter is almost certainly a *Marina*. The tragic disorder into which Pavón allowed the Nueva España collection to fall is too well known to need comment, and labels unless confirmed by strong circumstantial or descriptive evidence are of themselves untrustworthy. In this case the uncertainty surrounding the real nature of *Ps. citriodora* would become crucial only if var. *citrina* and var. *foliosa* were ever again considered specifically distinct entities. The earliest name for any segment of the species is certainly *Ps. foliolosa* Ait., fortunately verifiable by a holotypic specimen.

150b. Dalea foliolosa (Aiton) Barneby var. citrina (Rydberg) Barneby
(Plate CXXXV)

Characters as given in the key; n = 7_{II} (Spellenberg, 1973, as *foliosa* var.). — Collections: 61 (ix).

Brushy hillsides and open places, often in disturbed soils, becoming a colonial weed of roadsides and cornfields, in the zones of tree-ipomoea, thorn-forest, and arid grasslands, on a variety of sedimentary and volcanic substrates, sometimes abundant on malpais, locally plentiful between 670 and 1700 (2040) m (± 2200–5700, rarely 6800 ft) in the Bajio country of the middle Lerma-Santiago valley and throughout the Balsas Depression, s.-centr. Mexico, from interior Nayarit to Michoacán, Guerrero, s.-e. México, and Puebla, extending n., in scattered stations, along the e. slope of the Plateau from Veracruz to s. Tamaulipas, and s., becoming less common, through interior Oaxaca to Chiapas; apparently disjunct at 200–480 m (670–1600 ft) in the Zacapa desert of middle Río Motagua in Guatemala; also, presumably as an old but locally naturalized introduction, in Cordillera Oriental in Colombia and n.-e. Venezuela. — Flowering (according to altitude) July to December. — *Representative*: MEXICO. Tamaulipas: *von Rozynski 586* (NY). San Luis Potosí: *E. & K. Roe 2346* (WIS). Veracruz: *Purpus 2349* (NY, UC), *15,002* (C, F), *15,027* (UC). Puebla: *Purpus*

5651 (NY, UC); *Ripley & Barneby 13,694* (NY, US). NAYARIT: *Mexia 826* (F, GH, NY, UC); *Ripley & Barneby 14,051* (DAO, NY). JALISCO: *Gentry et al. 18,314* (RENNER, US); *Ripley & Barneby 13,439* (CAS, MEXU, NY, US). MICHOACÁN: *Hinton 12,322* (F, NY); *Ripley & Barneby 13,397* (CAS, MEXU, MICH, NY, US). MÉXICO: *Hinton 2720* (NY). MORELOS: *Ripley & Barneby 13,714* (CAS, NY), *14,566* (DAO, NY). GUERRERO: *Hinton 6683* (F, NY, Z), *9530* (ARIZ, F, NY), *9586* (F, NY). OAXACA: *L. C. Smith 208* (US); *Gentry 12,161* (MEXU); *Ripley & Barneby 14,650* (CAS, NY, US). CHIAPAS: *Breedlove 7893* (US). GUATEMALA. CHIQUIMULA: *Standley 73,729* (F), *74,372* (F); *Steyermark 30,087* (F). ZACAPA: *Standley 73,844, 74,596* (F). VENEZUELA. TRUJILLO: *Linden 1440* (K, NY, OXF, W). COLOMBIA. SANTANDER: *Molina & Barkley in 1948* (US). BOYACÁ: *Cuatrecasas 1094* (US). CUNDINAMARCA: *Triana in 1851–7* (K, NY).

Dalea foliolosa (Aiton) Barneby var. **citrina** (Rydberg) Barneby, Phytologia **26**: 1. 1973, based on *Parosela citrina* (lemon-scented) Rydb., N. Amer. Fl. **24**: 81. 1920. — "Type collected in fields about Tuxpan, Jalisco, October 27, 1904, *Pringle 8860...*" — Holotypus, NY! isotypi, F, GH, M, UC, W, Z! — *Parosela vernicia* var. *citrina* (Rydb.) Macbr., Contrib. Gray Herb., New Ser. **65**: 17. 1922. *Dalea citrina* (Rydb.) Bullock, Kew Bull. **1939**: 195. 1939.

Parosela vernicia (resinous) Rose, Contrib. U. S. Nat. Herb. **8**: 303. 1905. — "Collected by C. G. Pringle on lava fields near Yautepec, Morelos, October 26, 1902 (no. 8681)." — Holotypus, US! isotypi, F, GH, L, M, MEXU, NY, TEX, UC, W, Z! — *Dalea vernicia* (Rose) Greenm., Field Mus., Bot. Ser. **2**: 331. 1912.

IVE. Sectio CYLIPOGON (Rafinesque) Barneby

Perennial herbs, sometimes precociously flowering, mostly low (stems rarely over 5 dm, in *D. aurea* to 7.5 dm long), monocephalous or few-branched distally, the heads terminal; *foliage* strong-scented but inconspicuously glandular, mostly gray- or silvery-pilose with long straight hairs, the leaflets 3, 5, or 7, relatively ample (the largest usually $>$ 1 cm long); *intra-* and *post-petiolular glands* usually 0, if present minute and impressed; *spikes* either moderately dense or conelike; *bracts* deciduous at or long after anthesis; *calyx-tube* subsymmetrical at orifice, slightly up to 2½ times shorter than the lance-subulate to linear-caudate, eventually stiff, stellately spreading, plumose teeth; *petals* yellow, except in *D. aurea* fading pinkish-, orange-, or purplish-brown; *banner* either longer or shorter than the detached keel, this perched either high or low on the 10-merous androecium; *anther-connective* glandless; *pod* membranous in lower half, firmer distally, the prow formed by a glabrescent keel lying between two crests of antrorsely ascending bristly hairs. — Spp. 10, of arid grassland, desert, and prairie on the Mexican Plateau and centr. and s.-w. United States, most numerous in n.-e. Mexico and Texas, 1 extending n. to South Dakota, 2 s. to the Valley of Mexico and Puebla.

Dalea subgen. **Parosela** sect. **Cylipogon** (Raf.) Barneby, stat. nov., based on *Cylipogon* Raf., "Jour. Phys. Chim. Hist. Nat. **89**: 97. 1819", reprinted in Isis von Oken 1820, **1**: Lit. Anzug. 237. 1820. — Generitypus: *C. capitatum* Raf. = **Dalea aurea** Nutt.

Jamesia Raf., Atl. Jour. 145. 1832. — Generitypus: *J. obovata* Raf. = *Psoralea jamesii* Torr. = **Dalea jamesii** (Torr.) T. & G.

Parosela subgen. *Euparosela* XXXI. *Aureae* Rydb., N. Amer. Fl. **24**: 97. 1920. — Sp. lectotypica: *P. aurea* (Nutt.) Britt. = **Dalea aurea** Nutt.

The section is neatly defined and its members quickly recognized as such by a combination of herbaceous growth-habit, few (3–7) expanded (if narrow then elongate) leaflets, calyx-teeth longer than the tube, and petals that open yellow but (in all except *D. aurea*) turn pinkish or orange-brown in fading. The leaves and stems are heavily scented if bruised, but to the unaided eye they appear glandless or almost so; in reality the glands or oil-cells are small and immersed, concealed by a vesture of straight spiral hairs. Glands at insertion of the petiolules, in the intercostal membranes of the calyx, and on the anther-connective are likewise either absent or much less obvious than in the majority of daleas. The dilated prow of the pod, with its double brush of hairs, is another characteristic feature of sect. *Cylipogon*, almost duplicated in sympatric, blue-flowered subgen. *Theodora* sect. *Lachnostachyae*. Mahler (1965, p. 8, fig. 4, A–D) found a peculiar pollen in *D. aurea* and *D. nana*, a discovery which has been followed up by his student Blanche W. Meeson, who very generously shared with me the results of her study. Meeson surveyed the pollen of all members of the section except *D. boraginea* and *D. parrasana*, finding in *D. aurea* and *D. nana* subspherical amonotreme grains with protrusions emerging from the areoles of the highly reticulate sexine, differing at the specific level in the type of aperture; and in *D. wrightii* and the rest prolate tricolpate grains without protrusions. The grain of *D. luisana* has the surface ornament of the second type but is somewhat variable in outline and aperture, bridging the gap between the extreme types.

The daleas most nearly resembling sect. *Cylipogon* in foliage and facies are the monotypic *Sericeae* and *Agastachyae*. The *Sericeae* especially are similar in habit, but the petals are blue or violet and the pod lacks the double crest. The flower of *Agastachyae* is of the *Dalea* type, with minute free epistemonous petals and a reduced androecium of 5–6 members. The perennial, yellow-flowered members of sect. *Parosela* differ in being shrubs, prominently glandular-tuberculate or -punctate.

The center of speciation of sect. *Cylipogon* lies in northeastern Mexico and Texas west of the pine-oak woodlands. All of the ten known species occur within the combined territory of Texas, Coahuila, and Chihuahua east of Sierra Madre foothills. They are primarily plants of arid grassland or short-grass prairie, several of them advanced xerophytes adapted to desert conditions. The majority of the group are calciphile, most abundant on or even confined to cretaceous limestones, one or two tolerating or even prefering gypsum. But *D. aurea*, in particular, is less eclectic; while the two varieties of *D. nana* are divergently conditioned, one calciphile, the other calcifuge.

While *Cylipogon* seems to be a natural group, defined by numerous correlated characters, the corolla is remarkably diverse in relative proportions of the petals. A striking instance is furnished by the two species *D. wrightii* and *D. parrasana*, deceptively similar in facies and detail up to the corolla but (cf. Pl. CXXXVIII) there very different. In *D. wrightii* a banner with long claw and tiny blade is matched against comparably tiny, high-perching keel and wings, whereas in *D. parrasana* a more ample, short-clawed banner stands opposite low-perching, ample epistemonous petals as large or larger than itself. These modifications of the corolla, equivalent in scope to some that have been considered of profound systematic import, must have occurred, in the context of sect. *Cylipogon*, only at the specific level.

Key to the Species of Sect. *Cylipogon*

1. Main cauline leaves 3–7-foliolate, the majority always 5-foliolate.
   2. Bracts 2.5–5.5 mm long; *calyx* relatively short, exceptionally up to 7.5 mm long, if over 6.5 mm or its longest tooth over 4.2 mm long then the spike dense and conelike.
      3. Petals (almost always rubescent in age) small, the banner 4.4–5.5 mm, its blade 1.5–3.2 mm long, the keel-blades 3–4.8 (5) mm long; *stems* com-

monly diffuse and branched, 0.5–3 (3.5) dm long, only exceptionally erect and monocephalous; *spikes* either moderately dense or conelike, without petals 7–13 (15) mm diam. 151. *D. nana* (p. 563)

3. Petals (not rubescent) larger, the banner 6.3–8.6 mm, its blade 3–4.2 mm long, the keel-blades 4.7–7 mm long; *stems* usually erect, 3-7.5 dm long, either monocephalous or, if branched distally, over 4 dm long; *spikes* conelike, mostly 14–21 mm diam. 152. *D. aurea* (p. 567)

2. Bracts 6–12 mm long; *calyx* longer, well over 7 mm, its longest tooth at least 4.5 mm long; *spikes* moderately dense, not conelike.
   4. Banner 4.5–6.3 mm long, its claw and blade of ± equal length; *epistemonous petals* perched below middle of androecium, large, the keel-blades 4.3–5.9 mm long; local in s. Coahuila and San Luis Potosí. 154. *D. parrasana* (p. 570)
   4. Banner 7.5–9.5 mm long, its claw 2–3 times as long as blade; *epistemonous petals* perched above middle of androecium, small, the keel-blades (2.6) 3–4 (4.2) mm long; s.-e. Arizona to trans-Pecos Texas, s. to n.-e. Sonora, n.-e. Chihuahua, and Coahuila. 155. *D. wrightii* (p. 571)

1. Main cauline leaves all (or almost all) 3-foliolate (the uppermost sometimes 1-foliolate), 5-foliolate leaves few and obviously exceptional.
   5. Leaflets linear, linear-oblanceolate, or -elliptic; vesture of stems appressed or subappressed.
      6. Flower small, the banner less than 4 mm, the keel-blades ± 2–3 mm long; n.-e. Durango and s. Coahuila to centr. Tamaulipas, s. to Querétaro and Puebla. 156. *D. luisana* (p. 573)
      6. Flower larger, the banner 5–6.2 mm, the keel-blades over 5 mm long; e.-centr. Texas. 157. *D. hallii* (p. 574)
   5. Leaflets obovate or elliptic-obovate, if narrowly so then the vesture loosely pilose.
      7. Stems stiffly erect, up to 4 dm tall, and densely pilose throughout with vertical or subretrorse hairs ± 1 mm long; intercostal membranes of calyx charged with a single elongate gland; local in Coahuila (Múzquiz). 153. *D. boraginea* (p. 569)
      7. Stems if erect shorter and not pilose, if as long or pilose or both then pliantly humistrate up to the vertical spikes; intercostal membranes charged with 2–4 small discrete glands; if sympatric the stems less than 1 dm long.
         8. Spikes relatively loose, not conelike; *bracts* subhomomorphic; *blade* of banner 2.6–4.6 mm long, at least half as long as its claw; *keel-blades* over 5 mm long.
            9. Stems mostly 1–5 dm long, pliantly humifuse; calyx-teeth 3.5–5.8 mm long; s.-e. Chihuahua and San Luis Potosí to Jalisco, Michoacán, and valley of México. 158. *D. prostrata* (p. 575)
            9. Stems 0.1–1 dm long, incurved-ascending; *calyx-teeth* (5) 5.5–10 mm long; s.-e. Chihuahua n. to s.-e. Arizona, the e. foothills of the Rocky Mts. in Colorado, and the Oklahoma panhandle. 159. *D. jamesii* (p. 577)
         8. Spikes conelike; *bracts* dimorphic, the outermost broadly ovate-acuminate, the inner ones narrower; *blade* of banner 1.8–2.2 mm long, 2–3 times shorter than claw; *keel-blades* ± 3.5–4 mm long; n.-e. Chihuahua to n.-e. Nuevo León, just entering Texas (Pecos Co.), s. to n. Zacatecas and e. Durango. 160. *D. laniceps* (p. 579)

151. Dalea nana Torrey
(Plate CXXXVI)

Slender perennial herbs (0.5) 1–3.5 dm tall, silky-pilose-pilosulous nearly throughout with fine, straight, narrowly ascending hairs up to 0.6–1.3 mm long, usually densely so, the herbage silvery-gray when fresh becoming greenish-golden in dried specimens, the terete or ribbed, almost glandless stems either simple or branching near base, or distally, or both, the stems and branchlets all monocephalous; *leaf-spurs* 0.5–1.2 (1.5) mm long; *stipules* narrowly triangular or subulate, 0.5–2 mm long, pallid becoming dry and papery, stiff but not spinulose, thinly pilosulous, livid-tipped; *leaves* 1–2.5 (3) cm long, petioled, all or all but a few of the lowest and uppermost 5 (a few exceptionally 7)-foliolate, the margined punctate petiole mostly 4–11 mm long, the rachis shorter, usually (but not always) produced beyond the last pair of leaflets, the leaflets obovate, oblong-obovate, obovate-cuneate, elliptic, or oblanceolate, mostly obtuse and emarginate, sometimes abruptly acute or acuminate above the broad apex, either flat or folded, 3–15 mm long, dorsally carinate and faintly or distinctly punctate, either pubescent or more rarely glabrescent medially to glabrate above; *peduncles* 0–3.5 cm long, the first spike of branched stems usually pedunculate and the lateral ones sessile or nearly so; *spikes* variable in density, moderately loose to very dense and conelike, without petals 7–13 (15) mm diam, the villosulous axis 0.5–4 (5) cm long; *bracts* deciduous late in anthesis or afterwards, subhomomorphic, herbaceous above immediate base, 2.5–5.5 mm long, dorsally pilosulous and often punctate, ciliate; *calyx* (4.2) 4.5–6.5 (7.5) mm long, densely pilose with straight spreading-ascending spiral hairs up to 1.1–2.5 mm long, the tube 1.9–2.7 mm long, the ribs becoming prominent, pallid and cordlike, the membranous intervals charged with 1 row of 3–4 small transparent glands, the deltate- to triangular-aristate, plumose, reddish or livid teeth 2.2–4.2 (4.7) mm long; *petals* opening clear yellow, fading brownish, or when dried purplish or pinkish, eglandular, the epistemonous ones perched near middle of androecium 2.7–5 mm above hypanthium; *banner* (4) 4.4–5.5 mm long, the claw (2.6) 2.8–3.5 mm, the suborbicular-cordate, reniform, or subflabellate, obtuse or emarginate blade 1.5–3.2 mm long, (1.5) 2–3.6 mm wide; *wings* 2.6–4.3 mm long the claw 0.4–0.9 mm, the obliquely ovate blade 2.1–3.7 mm long, 0.9–1.8 mm wide; *keel* 3.8–6.1 mm long, the claws 0.8–1.5 (1.7) mm, the obovate to oblong-elliptic blades 2.8–4.8 mm long, 1.7–2.8 mm wide; *androecium* 10-merous, (6) 6.4–10 mm long, the longer filaments free for 1.1–2.3 mm, the pallid anthers 0.4–0.65 (0.7) mm long; *pod* (of the section) 2.5–3 mm long; *seed* castaneous, smooth, 1.8–2.2 mm long.

Variation in *D. nana* (sens. lat.) has been subject to comment since the earliest period of botanical surveys in the West. The plants differ in stature and mode of branching, in attitude of the stems, in density of the spikes, in shape of bracts, and to some small degree in number or shape or leaflets and pubescence on their upper face. The plant first described is prostrate, irregularly branched, pilose throughout, with relatively loose spikes of flowers subtended by broadly ovate bracts. The calyces of each vertical rank are at least 1 mm distant, with campanulate tube and teeth broadly triangular or deltate at base. The most obvious departure from this standard type is that known as *D. rubescens* Wats., with erect, simple stems and dense conelike spikes of flowers subtended by narrower, decidedly acuminate bracts. Here the calyces of each rank are pressed close together,

wholly concealing the axis even in pressed specimens, and their tube is vase-shaped, with narrower intercostal membranes and narrowly triangular-cuspidate teeth. The habit of extreme *D. rubescens* is less suggestive of the original *D. nana* than of some depauperate *D. aurea*, from which it is distinguished, however, by small rubescent petals. If this were all, two strongly characterized entities could be recognized, but in reality the conelike inflorescence is not confined to the plant with erect monocephalous stems but is found more commonly and over a much wider range on diffusely branching plants habitally simulating typical *D. nana*. Plants of this latter type, especially when more thinly pubescent, formed the nucleus of *Parosela carnescens* Rydb., a category found necessary so long as an erect growth-habit was thought to be taxonomically significant. It must be emphasized here that, except for the calycine characters mentioned above, not always sharply definite, the flowers of *D. nana, D. rubescens*, and *P. carnescens* are essentially alike. Growth-habit is evidently plastic in the complex, and pubescence, as nearly always in the genus, is unpredictably variable. The one neat racial division that coincides with credible dispersal patterns falls along the line of the two inflorescence types, each with its ordinarily distinctive bracts.

Key to the Varieties of *Dalea nana*

1. Spikes relatively loose, at least in age, the flowers of each vertical rank by late anthesis standing at least 1 mm apart along the axis, this partly revealed in pressed specimens; *bracts* broadly ovate-, obovate-, or elliptic-acuminate, the tail very short, the whole 2.5–5.5 mm long, 2–4 mm wide; *calyx-tube* usually campanulate, 2.2–3 mm diam; usually calcifuge and adapted to sandy substrates. 151a. var. *nana*.

1. Spikes from the first and permanently dense and conelike, the flowers of each vertical rank contiguous or nearly so, concealing the axis; *bracts* narrowly ovate- to lance- or elliptic-acuminate, 3.5–5.5 mm long, 1.2–2 mm wide; *calyx-tube* vase-shaped, 1.6–2.4 mm diam; strongly calciphile and adapted to stony or gravelly substrates. 151b. var. *carnescens*.

151a. Dalea nana Torrey var. nana
(Plate CXXXVI)

Always diffuse or prostrate, the stems sometimes simple and monocephalous, more often branched; *leaflets* 5 in nearly all leaves, mostly obtuse or subobtuse, varying from densely silky-pilose to glabrescent above (but upper surface not verdigris-green when dried); *calyx-teeth* mostly 2.2–4.2 mm, keel-blades 3–4.8 mm long; n = 7_{II} (Mosquin). — Collections: 104 (viii).

Sandy plains, dunes, stream-beds, sometimes becoming weedy along roads and railroads, generally avoiding rocky subsoils and prevailingly calcifuge, 10–1500 m (25–5000 ft), locally abundant and widespread over the Gulf Coastal Plain of s. Texas and adjoining Tamaulipas and Nuevo León, absent or nearly so from Edwards Plateau and calcareous caprock of trans-Pecos, reappearing, but more scattered, on the plains of w. and panhandle Texas, n. through panhandle Oklahoma to the valleys of the Canadian and Arkansas rivers in s.-w. Kansas and s.-e. Colorado, w. through the middle Pecos valley to the Rio Grande (upstream to Albuquerque), and s. and s.-w. to Río Conchos in centr. Chihuahua and around the s. end of the Mogollon massif in New Mexico into s.-e. Arizona; apparently absent from Coahuila, entering the Big

Bend country only at its north margin and along the bed of Rio Grande, on the limestones of n. Mexico and w. Texas largely replaced by var. *carnescens*. — Flowering April to September. — *Representative*: COLORADO: *Fremont* (from La Junta) *in 1845* (NY). KANSAS: *Rydberg & Imler 779, 975* (NY). OKLAHOMA: *Waterfall 9052* (NY, OKLA); *J. Engleman 969* (OKLA). NEW MEXICO: *R. T. Clausen 4617* (NY); *Maguire 11,404* (NY, UC); *Barneby 2479, 14,480* (NY). ARIZONA: *Rusby 564* (NY, UC); *Maguire 11,060* (NY); *Thornber 4350* (UC). TEXAS: *T. & L. Mosquin 5665* (NY); *York & Rogers 17* (ENCB, OKLA); *Ripley & Barneby 11,215* (NY), *14,508* (CAS, NY, US); *Tracy 9081* (NY, WIS); *R. Runyon 1398* (US). CHIHUAHUA: *Shreve 9061* (UC); *A. R. Moldenke 2082* (RENNER). NUEVO LEÓN: *Ripley & Barneby 14,784* (CAS, NY). TAMAULIPAS: *Barkley 14,599* (F, NY, UC).

Dalea nana (dwarf) Torr. ex Gray, Mem. Amer. Acad. II, **4** (Pl. Fendl. **1**): 31. 1849. — "[No. 130]. Sandy soil, Willow Bar, on the Cimarron; August." — Holotypus, collected by Fendler in 1847, GH! — *Parosela nana* (Torr.) A. Heller, Contrib. Herb. Franklin & Marshall Coll. **1**: 49. 1895.

Racial differentiation in var. *nana* is apparently still active, expressed in small size-differences in the spikes and in length of the bracts, calyx-teeth, and androecia. Material from the upper Arkansas (nomenclaturally typical) and thence southwest to Rio Grande and on, sporadically, into extreme southeast Arizona, has relatively thick spikes (10–13 mm diam), long bracts (3.5–5.5 mm) and calyx-teeth (2.6–4.2 mm), and long androecia (mostly 8–10 mm). The populations on the Coastal Plain in southern Texas and adjoining Mexico, extending into central Texas, have narrower spikes (mostly 7–9 mm diam), and correspondingly short bracts (2.5–4, rarely 4.5 mm), calyx-teeth (2.2–3.4, rarely 3.8 mm), and androecia (6–8 mm). These differences represent, however, trends rather than accomplished modifications, coinciding for the most part with different life-zones, but are not yet fully stabilized.

151b. DALEA NANA Torrey var. CARNESCENS (Rydberg) Kearney & Peebles (Plate CXXXVI)

Variable in growth-habit, the stems commonly diffuse and incurved-ascending, then either monocephalous or branched distally, more rarely virgately ascending to erect, again branched or not; *leaflets* 5 in most leaves, sometimes 3 in the lowest and uppermost, exceptionally 7, varying from emarginate to short-acuminate, densely pilose or glabrescent above, the upper face often, but not always, turning verdigris-green when dry; *spikes* 1–1.3 (1.5) cm diam, the axis 0.5–4 (5) cm long; *calyx-teeth* (2.8) 3.4–4.2 (4.7) mm long; *keel-blades* 2.9–3.7 mm long; 2n = 14 (Mosquin). — Collections 72 (viii).

Dry open hillsides and stony plains, mostly below 1200 m (4000 ft), widespread over most of Coahuila and the Edwards Plateau and Trans-Pecos n. of Rio Grande (Bravo), in Texas n. to San Saba, Taylor, Scurry, and Culberson counties, extending just into Eddy County, New Mexico, w. in scattered stations to centr. and s.-centr. Chihuahua, s.-e. Durango (at 1900 m); apparently somewhat isolated around the s.-e. edge of the Gila Basin in s.-e. Arizona (Santa Cruz and Cochise counties; to be expected in adjoining Sonora) and s.-w. New Mexico (Grant County); again disjunct on the low-lying limestones of lower Rio Grande valley in Webb and Zapata counties, Texas, and adjoining lowland Tamaulipas and Nuevo León, there climbing s.-ward into interior valleys (up to 1725 m) of Sierra Madre Oriental. — Flowering late March to September, perhaps throughout the year. — *Representative*: UNITED STATES.

ARIZONA: *Goodding 2276* (NY, UC); *Darrow & Haskell 2278* (UC). NEW MEXICO: *Ripley & Barneby 4200* (NY); *Degener 5032* (NY). TEXAS: *T. & L. Mosquin 5677* (NY); *Tharp 43-639* (NY, OKLA, UC); *Moore & Steyermark 3237* (NY, UC); *Tolstead 7132* (NY, UC); *Barneby 13,533* (CAS, NY), *13,535* (NY), *14484* (CAS, DAO, NY); *Correll & Schweinfurth 15,712* (RENNER). MEXICO. TAMAULIPAS: *Ripley & Barneby 13,246* (NY). NUEVO LEÓN: *Palmer 218* (F, NY, US); *Ripley & Barneby 13,250* (MEXU, NY); *V. L. Chase 7656* (F). COAHUILA: *Pringle 9015* (F, L, NY, Z); *Palmer 217* (F, NY, US); *Mueller 3116* (F); *Stewart 475* (GH). CHIHUAHUA: *Stewart & Johnston 2037* (GH), *2062* (GH, TEX); *Pringle 196* (BR, NY); *Mosquin et al. 6564* (NY); *Ripley & Barneby 13,909* (CAS, NY). DURANGO: *Ripley & Barneby 14,162* (NY).

Dalea nana Torr. var. **carnescens** (Rydb.) Kearn. & Peeb., Jour. Wash. Acad. Sci. **29**: 483. 1939; based on *Parosela carnescens* (turning flesh-pink, of the dried petals) Rydb., Fl. Rocky Mts. 483, 1063. 1917, as to descr., exclus. ref. — "Tex. — Colo. — Ariz." — No typus indicated in the protologue, and literature cited there all pertaining to var. *nana*. Rydberg, N. Amer. Fl. **24**: 99. 1920, selected as neotypus *Pringle 196*, from Chihuahua, but this far out of given range. Lectotypus, annotated in Rydberg's hand *Parosela carnescens*: Santa Rita del Cobre, Bigelow, in Mex. Bound. Surv., nov 5, 1851, NY! — *Dalea carnescens* (Rydb.) Bullock, Kew Bull **1939**: 195. 1939; Tidest. in Tidest. & Kitt., Fl. Ariz. & New Mex. 183. 1941.

Dalea rubescens (turning red, of the dried petals) Wats., Proc. Amer. Acad. **17**: 369. 1882. — "Western Texas; at the Limpia Pass [n.-e. of Fort Davis], 124 Wright, and at Fort Davis, Dr. V. Havard, 1881." — Lectotypus: *Wright 124*, GH! isotypi, NY, OXF! paratypus (*Havard 5*), GH! — *Parosela rubescens* (Wats.) Vail, Trans. N. Y. Acad. Sci. **14**: 34. 1894.

Dalea nana "var. elatior (pedalis) etc..." Gray, Pl. Wright. **1**: 46. 1852, described but not formally named; *Parosela elatior* Vail, Bull. Torrey Club **24**: 15. 1897, nom. illegit. *Dalea nana* var. *elatior* Gray ex B. L. Turner, Leg. Tex. 157. 1959, without validating reference to earlier description.

Parosela whitehouseae (Eula Whitehouse, 1892–) Tharp & Barkl., An. Esc. Nac. Ci. Biol. **4**: 285. 1946 & Amer. Midl. Nat. **37**: 781, fig. 1. 1947. — "...Menard County, Texas, July 7, 1928, *B. C. Tharp s. n.*....." — Holotypus, TEX!

Parosela lesueuri (David Hardeman LeSueur, 1909–1942) Tharp & Barkl., An. Esc. Nac. Ci. Biol. **4**: 286. 1946 & Amer. Midl. Nat. **37**: 783, fig. 2. 1947. — "Stockton to Sheffield, Texas, June 3, 1940, *B. C. Tharp s. n.*....." — Holotypus TEX!

The status of var. *carnescens* is still debatable. The erect phase of it is often mistaken for *D. aurea*, the prostrate one for genuine *D. nana*, and the three entities collectively form an almost uninterrupted sequence of variations. However there is a better-marked discontinuity in flower-size between *D. aurea* and the remainder than between the two varieties of *D. nana* accepted here. Turner (1959, p. 157, map 99) suggested the possibility that the erect forms of var. *carnescens* are hybrids involving *D. aurea*. In western Texas *D. aurea* and *D. nana* are sympatric and sometimes closely associated, and the opportunity for pollen-exchange exists. But the same situation arises also in many places in central Texas, without giving rise to intermediate types. Moreover var. *carnescens* in more or less diffuse aspects extends far south and west of the limits to *D. aurea* and over vast territories in northern Mexico from which we have records of neither genuine *D. nana* nor *D. aurea*. The variants in stature and pubescence that are referred here to var. *carnescens* are reasonably, I think, interpreted as minor intraspecific modifications, without recourse to hypothetical introgression.

The main range of var. *carnescens* extends over the limestone country of west-central Texas and Coahuila, surrounded north, east and west by var. *nana*, which is generally cal-

cifuge. Where it invades the territory of var. *nana*, as in the lower Rio Grande valley and in contiguous south corners of Arizona and New Mexico, the two forms remain, wherever I have seen them, segregated by soil-preference, var. *carnescens* always on limestone rubble, caliche, or gypsum, and var. *nana* on acidic or neutral sands. It is possible that they should be recognized as distinct species, but (as mentioned above) occasional morphological intermediates occur, difficult to assign to variety (but none, as yet, accompanied by habitat data).

My definition of var. *carnescens* coincides essentially with *D. nana* var. *elatior* of Turner (1959), wide enough to embrace those plants with erect monocephalous stems (*Dalea rubescens* Wats.) which simulate depauperate *D. aurea* as well as those diffusely branching ones referred by Rydberg's key (1920, p. 70), depending on density of vesture, either to *P. carnescens* or *P. nana*. Rydberg misinterpreted the leaves of *D. rubescens*, the isotype of which at NY has lost its main cauline ones, as trifoliolate, and compared the species with *D. jamesii*, only remotely related. At the same time he was annotating as *P. rubescens* 5-foliolate specimens properly belonging there. The protologue of *P. carnescens* includes references to the plant of southeastern Colorado which had been listed in prior floristic works as *D. nana* "var. *elatior*" or *D. rubescens*, but this is genuine var. *nana*, not the plant that Rydberg actually described. Early collections of var. *carnescens* from Arizona had already been equated by Watson (Proc. Amer. Acad. **20**: 360) with his own, thitherto Texan, *D. rubescens*. The more modern *P. lesueuri* and *P. whitehouseae* represent merely vigorous and starveling individual populations of the common form, the more vigorous, as often, greener.

The varietal epithet *elatior*, often applied to var. *carnescens* in broader or narrower sense, is based on a misconception and has no nomenclatural standing in this context. As noted by Heller (Muhlenbergia **1**: 30. 1901), the word *elatior* was used by Gray in *Plantae Wrightianae* merely as a descriptive term, the first of a phrase denoting difference from *D. nana* as then known. As employed by Porter & Coulter (Syn. Fl. Colo. 22) the name "var. *elatior*" is appended to a description of *D. nana* var. *nana*, and if validly published thereby, must fall into synonymy of var. *nana*. As employed by Turner, in the sense of the present var. *carnescens*, it fails by lack of reference to prior description to qualify as legitimate. The *Parosela elatior* of Vail, based ultimately on the same source, is illegitimate for other reasons.

152. DALEA AUREA Nuttall

(Plate CXXXVII)

Perennial herbs with (1) 3–9 (15) stiffly erect or virgately ascending stems from a short caudex, (2) 3–7.5 dm tall, silky-pilose or -pilosulous almost throughout with subappressed, ascending, and often a few spreading hairs up to (0.5) 0.7–1.3 (1.5) mm long, the stems simple and monocephalous or, less often, branched distally, with 1 or few small lateral spikes elevated beyond the terminal one, the leaflets ± bicolored, densely pubescent and punctate beneath, above more thinly pubescent and deeper (when dried sometimes verdigris) green, more rarely medially glabrescent or truly glabrous, the vesture silvery-gray when fresh, early tarnishing when dried; *leaf-spurs* 0.7–1.5 mm long; *stipules* subulate to narrowly lanceolate, early becoming dry, fragile, stramineous, (0.8) 1.2–3 mm long, thinly pilosulous or glabrate; *leaves* 1–3.5 (4) cm long, scattered and reduced in size upward, the uppermost sometimes bracteiform, all usually deciduous as the fruit ripens, the margined and punctate petiole and rachis together 0.7–2.5 cm long, the leaflets 3–7, always 5 on some leaves, obovate to oblong-oblanceolate or oblanceolate, obtuse, obtuse and mucronulate, rarely acute,

flat or loosely folded, (3) 4–16 (20) mm long, the terminal one usually raised beyond the last pair; *spikes* very shortly peduncled or sessile (but sometimes appearing long-pedunculate due to reduction of upper leaves), densely many-flowered, conelike, ovoid becoming oblong-cylindroid, without petals (12) 14–21 mm diam, the densely pilosulous axis (1) 1.5–6 cm long; *bracts* deciduous only with the calyces, subdimorphic, the lowest ovate-cuneate, firm, 2.5–5.5 mm long, the inner ones lance-elliptic acuminate, becoming papery, all densely silky-pilose dorsally and ciliate except for the slender livid tip, the lowest always, often all, finely punctate; *calyx* 6.1–7.4 mm long, densely silky-pilose with spreading-ascending hairs up to 1–2.2 mm long, the turbinate tube 2.2–2.8 mm long, the stramineous ribs becoming prominent, cordlike, the membranous intervals charged with 1 row of 3–4 small transparent glands, the narrowly lance-acuminate teeth 3.5–5 mm long, plumose but aristiform, at tip livid and glabrescent, at anthesis ± connivent, in fruit stellately divergent; *petals* pale, clear yellow, unchanged in drying, the banner-blade sometimes charged with a crescent of glands, the rest glandless, the epistemonous ones perched near middle of androecium, the keel 4.8–7.3 mm above hypanthium; *banner* 6.3–8.6 mm long, the claw 3.5–5 mm, the deltate-cordate obtuse or subacute, hooded blade 3–4.2 mm long, 3.2–4.4 mm wide, recessed at the claw into a cornet; *wings* 5.2–6 mm long, the claw ± 1 mm, the obliquely ovate or oblong blade 4.7–5.6 mm long, 2–2.4 mm wide; *keel* 5.7–8.5 mm long, the claws 1.4–2.1 mm, the broadly oblong-elliptic blades (4.7) 5–7 mm long, 2.6–3.2 mm wide; *androecium* 10-merous, 10–12.5 mm long, the longer filaments free for 2.5–3 mm, the pallid anthers 0.65–0.9 (0.95) mm long; *pod* (of the section) 3–3.5 mm long; *seed* castaneous or mahogany-brown, smooth and lustrous, 2–2.4 mm long; $n = 7_{II}$, $2n = 14$ (Mosquin). — Collections: 151 (iv).

Prairies and dry hillsides, on a variety of soils but perhaps most vigorous on sedimentary bedrock, especially limestone, 10–1800 (1950) m (30–6500 ft), widely dispersed and common over the greater part of Texas w.-ward from the post-oak savanna belt, s. into the Gulf Coastal Prairie, n., still common, through Oklahoma and the western two thirds of Kansas (e. to Cowley and Republic counties) into (becoming rare and scattered) w. Nebraska and s.-w. South Dakota, and w., nowhere abundant, into Colorado e. of the Rocky Mountain foothills (up the Arkansas into e. Fremont County), and the Pecos valley in New Mexico; disjunct in e.-centr. Arizona (extreme s. Navajo County); from Texas extending s. into the mountains of Coahuila (Sierras Encantada, del Carmen, de la Madera, de la Gloria, de Monclova) and adjoining Chihuahua (Sierra de Encinillas). — Flowering (June) July to September. — *Representative*: UNITED STATES. South Dakota: *Rydberg 608* (NY). Nebraska: *Clements 2708* (NY); *Tolstead 411054* (UC). Colorado: *Clokey 4195* (UC); *W. A. Weber 4401* (UC). Kansas: *C. H. Thompson 27* (NY, UC); *Rydberg & Imler 489* (NY); *McGregor & Jackson 102* (NY). Oklahoma: *E. J. Palmer 12,595* (NY, UC); *Waterfall 15,964* (OKLA, UC); *G. W. Stevens 1048* (NY, OKLA). Texas: *Lindheimer 754* (NY, UC); *A. Heller 1856* (L, NY, OKLA, UC); *T. & L. Mosquin 5703* (NY); *Moore & Steyermark 3613* (NY, UC); *Ripley & Barneby 14,785* (DAO, NY). New Mexico: *Degener 5031* (NY); *Br. Anect 162* (NY). Arizona: *Palmer 611* (NY, UC, US). MEXICO. Chihuahua: *Stewart 757* (GH, TEX). Coahuila: *Wynd & Mueller 464* (ARIZ, GH, NY); *Marsh 690* (F, GH, OKLA, TEX), *2145* (OKLA, GH); *Palmer 226* (NY, US).

Dalea aurea (golden, of the petals) Nutt. ex Pursh, Fl. Amer. Sept. 740. 1814. — "*In* Upper Louisiana. *Bradbury*...v. s. in *Herb.* Bradbury.", fide Nuttall, Gen. **2**: 101. 1818, "near White River, Missouri [= s. South Dakota]" — Holotypus not seen; isotypus, labelled "*Dalea aurea*, Bradbury, herb. Lambert.", NY (herb. Torr., fragm.)! — *Psoralea aurea*

(Nutt.) Poir. in Lamk., Encycl. Suppl. **4**: 590. 1816. *Parosela aurea* (Nutt.) Britt., Mem. Torrey Club **5**: 196. 1894.

Cylipogon capitatum (with flowers in heads) Raf., "Jour. Phys. **89**: 97. 1819"; cf. supra sub sect. *Cylipogon*. — No typus known; the description probably based on accounts of Pursh and Nuttall. — *Petalostemon capitatum* (Raf.) DC., Prod. **2**: 244 (with note of interrogation). 1825.

The Golden Prairie-clover, a common ornamental wild-flower of the southern Prairie States, is distinguished from other yellow-flowered daleas by its tall wandlike stems ending in one, or sometimes one large and a few smaller dense, conelike heads of silvery-pilose calyces. A rare tall form of *D. nana* sometimes approaches it in stature, but has much smaller petals that, unlike those of *D. aurea*, turn pinkish-brown when dried. The rare *D. boraginea*, found within the range of *D. aurea* in Coahuila, is similar in habit, but has all leaves 3-foliolate (not mostly 5-foliolate) and a characteristic hispid pubescence.

The species varies little in gross appearance or in fine detail. The leaflets may be silvery-pubescent on both sides or glabrate above, and the upper surface, always darker green (below the vesture) than the lower, often but not invariably turns verdigris-green in the herbarium, a curious feature common to this and some sympatric but only distantly related members of subgen. *Dalea*. The climatic tolerance of *D. aurea* is exceptional, for it extends in Texas southward out onto the sands of the Gulf Coastal Prairie and in Colorado and New Mexico up to the Rocky Mountain piedmont. It is reported from Wyoming, but I have seen no specimen from west of the Black Hills in South Dakota.

153. DALEA BORAGINEA Barneby
(Plate CXXXVII)

Like *D. aurea* in habit, 3.5–5 dm tall, the simple and monocephalous or distally few-branched stems densely pilose like the foliage with stiff, erect or subretrorse hairs up to 0.9–1.1 mm long, the foliage bicolored, the leaflets (dry) verdigris-green above, paler, more densely pilose and minutely punctate beneath; *stipules* subulate ± 2–2.5 mm long, becoming papery, fragile, recurved; *leaves* petioled, the main cauline ones 2–3.5 cm long, 3-foliolate, the broadly margined, ventrally flattened petiole and rachis together up to 9–14 mm long, the pair of leaflets obovate, the terminal one larger, broadly elliptic, 1–2.4 cm long, stalked above the pair, all prominently carinate dorsally by the pallid midrib, gland-mucronulate; *spike* subsessile, very dense, in fruit ± 1.8 cm diam, the axis up to 4–6 cm long; *bracts* marcescent, narrowly lance-caudate, up to 9 mm long; *calyx* 6.7–7.6 mm long, stiffly setulose-barbate with spreading hairs up to 1.5–2 mm long, the tube 2.5–2.8 mm long, somewhat recessed behind the banner, the ribs prominent, the intercostal membranes charged with one (rarely interrupted) linear gland-body, the triangular-aristate, finally spreading teeth up to 4–4.9 mm long; *petals* yellow, incompletely known from marcescent fragments; *banner* 3.5–5 mm long, the slender claw 2.2–3.3 mm, the ovate-deltate blade ± 1.6–1.8 mm long, 1.8–2.2 mm wide, open ventrally at base, sometimes setulose dorsally and ciliate, the claw sometimes bristly at base; *wings* 3 mm long, the claw 0.7 mm, the obliquely ovate blade 2.6 mm long, 1.7 mm wide; *keel* not seen; *androecium* (seen only faded, without anthers) 7 mm long, the filaments free for ± 1.4 mm, the petal-sockets situated 4 mm above hypanthium; *pod* ± 3.5 mm long, quadrately obovate in profile, nearly 3 mm wide, the valves hyaline and glabrous in lower ⅔, firmer and densely pilose along the double prow; *seed* ± 2.5 mm long. — Collections: 2 (o).

Habitat not recorded, but to be expected on rocky limestone slopes at ± 1000 m, known only from Sierra de Santa Rosa, mpo Melchor Múzquiz, Coahuila. — Flowering in June. — *Material*: COAHUILA. M. Múzquiz: valley of Rancho Agua Dulce, *Wynd & Mueller 420* (US).

Dalea boraginea (hispid like borage) Barneby, sp. nov., *D. aureae* habitu similis sed caulis calycisque pube patula rigidiuscula, foliis caulinis omnibus pinnatim 3 (nec 5)-foliolatis, tuboque calycino inter costas glandula singula elongata lineari (nonnumquam hinc inde strangulata vel brevissime interrupta) obsito diversa. Petala infauste incomplete nota, sed vexilli lamina minima eam *D. wrightii*, foliis habituque toto absimilis, refert. — COAHUILA. Melchor Múzquiz: Palm Canyon, July 9, 1936, *Ernest Marsh 379.* — Holotypus, GH; isotypi, F, MEXU, OKLA, TEX (2 sheets).

A strongly marked but incompletely known species, resembling *D. aurea* in its erect virgate stems ending in one or few massive, conelike spikes, but differing in the hispid vesture of stem and calyx, in the pinnately trifoliolate leaves, and in the single linear gland on each intercostal membrane of the calyx. Its close relationship in sect. *Cylipogon* will require reassessment when the epistemonous petals become better known. Marsh collected *D. aurea* also, several times, in Múzquiz municipality (Nos. *56*, GH, TEX; *1281*, F, GH, TEX; *2145*, GH, OKLA), but these specimens are characteristic of their species and show no hint of passage toward *D. boraginea*. The small vexillum suggests that of *D. wrightii*, a smaller plant with always more numerous leaflets. The only trifoliolate member of sect. *Cylipogon* known to occur in the same region is the dwarf *C. laniceps*, including stem and spike less than 1 dm tall.

154. DALEA PARRASANA Brandegee
(Plate CXXXVIII)

Low suffruticose perennial herbs with woody roots (yellow beneath the brown bark) and shortly forking caudex, strigose-pilosulous with straight, subappressed and often a few narrowly ascending hairs up to 0.4–1 mm long, the several or numerous, eglandular, commonly canescent stems erect and ascending in low tufts, mostly simple, rarely 1–3-branched distally, the spikes solitary, terminal, the foliage gray, the leaflets pubescent both sides, minutely dotted beneath; *leaf-spurs* 0.5–1 mm long; *stipules* narrowly subulate to linear-caudate, 1.5–4.5 mm long, early becoming dry, stiff, fragile, stramineous below the livid tips; *leaves* petioled, 1–3 (3.5) cm long, all (or all but a few uppermost) 5 (7)-foliolate, the margined, punctate petiole 2–8 (13) mm, the rachis 1–9 (14) mm long, the leaflets narrowly ovate to lanceolate or rhombic-elliptic, acute to short-acuminate, flat or loosely folded, 3–15 mm long, all carinate dorsally by the midrib, the terminal one longest, stalked; *spikes* sessile or nearly so, ovoid, moderately dense, without petals 1.5–2.2 cm diam, the axis becoming 0.5–3 (3.5) cm long; *bracts* persistent through anthesis, subhomomorphic (the lowest a little smaller and firmer), broadly oblong- or ovate-elliptic, short-acuminate, 6–12 mm long, 3.4 –4 mm wide, navicular and embracing (almost concealing) the calyx, pallid at base, submembranous, green or purplish distally, delicately reticulate-nerved, dorsally thinly pilose or subglabrous, minutely punctate, ciliate; *calyx* 7.2–11.8 mm long, thinly pilose with fine spreading lustrous spiral hairs up to 2–3.5 mm long, the broadly campanulate tube 2.2–3.4 mm long, recessed behind banner, the ribs slender, scarcely prominulous, the flat membranous intervals charged with 1 row of 3–4 small transparent glands, the deltate-aristate, plumose, livid-tipped teeth 4.5–8.4 mm long; *petals* yellow fading brown or pinkish-brown, eglandular, the epistemonous ones perched below middle of androecium; *banner* 4.5–6.3 mm long, the claw 2.2–3 mm, the deltate-cordate blade 2.5–3.8 mm long, 2.8–4 mm wide; *wings* 5–5.4 mm long, the claw 1.2–2 mm, the obliquely obovate-elliptic blades 3.8–4.7 mm long, 2–3 mm wide; *keel* 5.5–6.5 mm long, the claws 1.7–2.5 mm, the almost half-obovate blades strongly oblique, 4.3–5.9 mm long, 2.3–3.5 mm wide; *androecium* 10-merous, 7.5–9 mm long,

the longer filaments free for 2.6–3 mm, the greenish-yellow anthers (0.7) 0.8–1.4 mm long; *ovary* pilosulous distally, the pod and seed not seen. — Collections: 6 (i).

Dry rocky or shaley hills, commonly on or near gypsum outcrops, 1525–1800 m (5080–6000 ft), local, known only from s. Coahuila (mpos Parras, Saltillo, Ramos Arizpe) and from an unspecified station in San Luis Potosí. — Flowering August–November, perhaps also in spring. — *Material*: COAHUILA. Parras: Parras, *Purpus in 1905* (UC); *Henrickson 6160* (TEX). Saltillo: 10 mi w. of Saltillo, *Ripley & Barneby 13,282* (CAS, K, MEXU, MICH, NY, US). Ramos Arizpe: 12 km n. of Saltillo, *Ripley 14,971* (NY). SAN LUIS POTOSÍ: ——, *Parry & Palmer 162* (NY).

Dalea parrasana (of Parras, Coahuila) T. Bdg., Univ. Calif. Pub. Bot. **4**: 179. 1911. — "No. 4741, collected on Sierra de Parras, Coahuila..." Holotypus, collected by C. A. Purpus in oct 1910, UC! isotypus, US!

This sharply distinct species was collected first, somewhere in San Luis Potosí, by Parry & Palmer and misidentified as *A. wrightii*, which its dwarf stature and 5-foliolate leaves superficially suggest. The specimens were later mentioned by Vail (Bull. Torrey Club **24**: 16. 1897) as representing a small form of *Parosela wrightii* intergradient to *P. luisana*. The latter resembles *D. parrasana* in its appressed vesture but differs greatly in its trifoliolate cauline leaves, smaller bracts, and much smaller, differently proportioned flower. The important differences in the flowers of *D. parrasana* and *D. wrightii*, which are indeed similar in facies and no doubt close kindred, have been emphasized in the key to the section and in the accompanying plate.

At Parras, where I have seen the plants only in sterile condition, and in the hill country west of Saltillo, *D. parrasana* is associated with species of *Nama* and *Anulocaulis* known to be obligate gypsophytes, and it is suspected that its apparent rarity is due to its localization on gypseous formations. The gypsum beds of San Luis Potosí are very far from fully explored, and may well yield further populations of this interesting plant.

155. DALEA WRIGHTII Gray
(Plate CXXXVIII)

Low or dwarf perennial herbs, sometimes flowering precociously but ultimately developing a woody root and shortly forking caudex, excluding the massive terminal spikes 1.5–20 (30) cm tall, densely silky-pilose or -pilosulous with ascending or subappressed, mostly straight but sometimes ± contorted (then subtomentose) hairs up to 0.8–1.5 mm long, the stems usually few, (1) 2–5, rarely more numerous, simple, the shorter ones erect, the longer decumbent and distally incurved, the foliage gray or silvery, the leaflets pubescent both sides, not obviously glandular, the inflorescence pilose-barbate; *leaf-spurs* 0.6–1.5 mm long; *stipules* subulate to narrowly lance-acuminate, becoming stiff, stramineous, brittle, the tips livid; *leaves* 1–3.5 (4) cm long, the stiff, narrowly margined petiole (2) 4–15 mm, the rachis (0.5) 1.5–12 mm long, nearly always produced beyond the last pair of leaflets, the 5 leaflets rhombic-ovate, elliptic, oblong-elliptic, or lanceolate, acute or acuminate, flat or loosely folded, 4–15 (20) mm long, dorsally carinate by the midrib, the terminal one largest; *spikes* sessile or nearly so, moderately dense, ovoid becoming cylindroid, without petals 1.7–2.3 cm diam, the pilosulous axis (1.5) 2–6 cm long; *bracts* deciduous at or shortly after anthesis, 6–12 mm long, subdimorphic, the lowest obovate-acuminate, firm, densely pubescent, the rest usually longer and always narrower, lance- to narrowly oblong-elliptic, acute to acuminate, submembranous, pallid at base, green (turning stramineous) or purple distally, densely ciliate, dorsally glabrescent and minutely

punctate, their base wrapped around the calyx but becoming flat distally; *calyx* (8.5) 9–12.3 mm long, densely pilose with spreading and ascending spiral hairs up to 1.5–4 mm long, the turbinate tube (2.5) 2.7–3.5 mm long, somewhat recessed behind banner, the ribs slender becoming prominulous, the flat membranous intervals charged with 1 row of ± 4 small transparent glands, the deltate- or triangular-aristate, finally spreading, plumose teeth (6) 6.5–9.3 mm long; *petals* yellow, in nature fading orange-brown, often turning dull pink when dried, all eglandular, the epistemonous ones perched above middle of androecium, 5.5–8 mm above hypanthium; *banner* 7.8–9.5 mm long, the linear claw 5.8–7.5 mm, the cordate and obtuse or spade-shaped and subacute blade 2–3 mm long, 2.4–3.4 mm wide; *wings* 3.3–4 mm long, the claw 0.7–1.3 mm, the oval-ovate blade 2.6–3.4 mm long, 1.8–2.3 mm wide; *keel* (3.3) 3.5–5.2 mm long, the claws 0.7–1.2 mm, the oval-obovate blades (2.6) 3–4 (4.2) mm long, 1.6–2.2 mm wide; *androecium* 10-merous, 10–13 mm long, the longer filaments free for ± 1.5 mm, the pallid anthers 0.5–0.7 mm long; *pod* (of the section) 2.8–3.5 mm long; *seed* castaneous, smooth and lustrous, 2–2.8 mm long; 2n = 14 (Mosquin). — Collections: 73 (iii).

Stony slopes and knolls in the foothills of desert mountains and in thin grassland of rolling plains, on a variety of soils but most vigorous and abundant on limestone, 530–1720 m (1600–5700 ft), locally common over the greater part of Coahuila, n.-ward from Saltillo, the eastern third of Chihuahua, and trans-Pecos Texas w.-ward from the mouth of Pecos River, w. in United States across the s. tier of counties in New Mexico and Arizona as far as Santa Rita Mts., Pima County, thence feebly s. to the headwaters of Río Nacozari and Babispe in the n.-e. corner of Sonora. — Flowering April to June, August to November. — *Representative*: UNITED STATES. ARIZONA: *Maguire 11,163* (NY); *Darrow, Phillips & Pultz 1351* (NY). NEW MEXICO: *Waterfall 12,930* (OKLA). TEXAS: *Correll & Johnston 21,806* (RENNER); *Hinckley 1520* (NY, RENNER); *T. & L. Mosquin 5641* (NY); *Correll & Rollins 23,574* (RENNER). MEXICO. SONORA: *S. S. White 4148* (ARIZ). CHIHUAHUA: *Stewart 992* (GH, TEX), *2088* (GH); *Ripley & Barneby 13,896* (CAS, NY). COAHUILA: *Johnston 8237, 8440, 8683* (GH); *Ripley & Barneby 14,221* (NY), *14,509* (DAO, NY).

Dalea wrightii (Charles Wright, 1811–1885) Gray, Pl. Wright. **1**: 49. 1842 ("*Wrightii*"). — "Dry hills 80 miles west of the Pecos [= Barrilla Spring in e. Jeff Davis Co., Texas, acc. Hinckley, Amer. Midl. Nat. **44**: 490] and on mountains near El Paso; Aug., Sept." — Holotypus, *Wright 134*, GH! isotypus, US! — *Parosela wrightii* (Gray) Vail, Bull. Torrey Club **24**: 16. 1897.

Dalea sabulicola (growing in gravel) T. Bdg., Univ. Calif. Pub. Bot. **4**: 179. 1911. — "Collected on Sierra de la Paila [mpo Parras] Coahuila, growing in gravelly soil. [*C. A. Purpus*] No. 4740." — Holotypus, UC! isotypus, US!

Parosela warnockii (Barton Holland Warnock, 1911–) Tharp & Barkl., An. Esc. Nac. Ci. Biol. **4**: 284. 1946 & Amer. Midl. Nat. **37**: 784, fig. 3. 1947 ("*Warnockii*"). — "[Fort] Stockton to Sheffield, Texas, June 3, 1940, *B. C. Tharp s. n.*..." — Holotypus, TEX! isotypi, NY, UC!

A modest but attractive plant, becoming conspicuous in its barren home by the proportionately immense spike of plumose calyces rising vertically from short and erect or longer diffuse stems clad in gray-pilose, 5-foliolate leaves. Among close kindred with similar leaves it is easily recognized by the long-stalked banner expanded into a tiny limb that stands opposite a diminutive, high-perching keel. In Texas, Chihuahua, and New Mexico the ranges of *D. wrightii* and *D. jamesii* overlap, but need never be confused, despite a superficially similar facies, the latter being distinguished by its more silvery trefoil leaves

and ample petals. Like many herbs adapted to desert conditions, the growth of which depends so directly on fluctuating and uncertain rainfall, *D. wrightii* is subject to great variation in stature, the stem that in thirsty years bears a spike longer than itself only a few centimeters above the root-crown becoming in favorable seasons up to 2 or even 3 decimeters long. Independently of stature the pubescence varies somewhat in quality, ordinarily pilose, but sometimes formed of more or less contorted hairs and incipiently tomentose. The types of *Dalea sabulicola* and *Parosela warnockii* were both drought-inhibited, the latter in addition subtomentose. Rydberg correctly reduced the first, and Turner (1959, p. 156) the second, to *D. wrightii*.

156. DALEA LUISANA Watson
(Plate CXXXIX)

Slender, diffuse or prostrate herbs, perennial but precociously flowering, from a slender but eventually woody root, the ± 3–9 stems mostly 1–15, rarely to 20 cm long, 1–2-cephalous, the longer ones radiating from the root-crown, simple or few-branched, the shorter ones (and the subradical spurs, if present) erect-ascending, strigulose-pilosulous throughout with stiff straight appressed and narrowly (or a few longer widely) spreading hairs up to 0.6–1 mm long, the inflorescence pilose-barbate, the leaves greenish-cinereous or canescent, the leaflets either pubescent or glabrate above; *leaf-spurs* 0.5–1 mm long; *stipules* linear-lanceolate, erect or outwardly curved, 2–6 mm long, pilosulous, becoming stiff and brownish; *leaves* petioled, 1–3 (3.5) cm long, the narrowly margined, sometimes obscurely punctate petiole and rachis together 0.5–2.5 cm long, the 3 leaflets linear-oblanceolate or -elliptic, acute or subacute, 4–16 (20) mm long, the stalked terminal one longest, all usually ± folded; *spikes* sessile or shortly pedunculate, the peduncles not over 1 cm long, all terminal or the earliest becoming leaf-opposed, moderately dense, ovoid or oblong-ovoid, without petals 9–14 mm diam, the pilosulous axis 0.5–2.5 (3.5) cm long; *bracts* deciduous only with the ripe pod, 5–6 mm long, loosely silvery-pilose, the tube 2–2.3 mm long, slightly recessed behind banner, the ribs (like the teeth) reddish or livid, slender, the pallidly membranous intervals charged with 1 row of ± 4 small transparent glands, the deltate-aristate, plumose teeth 3–3.7 mm long, stellately spreading in age; *petals* clear yellow, fading reddish- or orange-brown, eglandular, the epistemonous ones perched a little below middle of androecium; *banner* 2.8–3.8 mm long, the linear claw 1.9–2.4 mm, the reniform emarginate or obcordate and subacute blade 1.2–1.6 mm long, 1.4–1.9 mm wide; *wings* 1.8–2.5 mm long, the claw 0.6–1 mm, the obliquely ovate, bluntly short-auriculate blade 1.2–1.6 mm long, 1.4–1.9 mm wide; *keel* 3.1–3.9 mm long, the claws 1.1–1.4 mm, the obliquely obovate or oblong-obovate blade 2.1–2.8 mm long, 1.4–1.9 mm wide; *androecium* 10-merous, 4.5–6 mm long, the longer filaments free for 1–1.4 mm, the pinkish-brown anthers (0.3) 0.35–0.5 mm long; *pod* (of the section) 2.5–2.8 mm long; *seed* olivaceous or castaneous, smooth and glossy, 1.7–2.1 mm long; 2n = 14 (Mosquin). — Collections: 17 (vii).

Low hills and plains, in grama grassland and thorn-cactus forest on limestone, 1200–2230, perhaps 2730 m (3600–6700 or 8200 ft), widely dispersed but relatively uncommon (or overlooked), along the arid w. slope of Sierra Madre Oriental and adjoining Meseta Central from s.-e. Coahuila (mpo Ramos Arizpe) and adjoining Nuevo León (mpo Galeana) to n. Querétaro (mpo Cadereyta), w. into n.-e. Durango (mpos Rodeo and Cuencamé) and n.-e. Zacatecas (mpo Mazapil), in Sierra Madre just entering Tamaulipas (Miquihuana, here reported from 8200 ft); disjunct in the Tehuacán

desert in s.-e. Puebla. — Flowering June to November. — *Representative*: DURANGO: *Mosquin et al. 6902* (NY); *Ripley & Barneby 13,504* (MEXU, NY), *13,510* (CAS, NY). COAHUILA: *Ripley & Barneby 13,521* (NY). NUEVO LEÓN: *Bierner & Turner 96* (NY). ZACATECAS: *Ripley & Barneby, s. n.* (NY). SAN LUIS POTOSÍ: *Purpus 5191* (F, NY, UC); *Ripley & Barneby 13,318* (CAS, MICH, NY, US), *14,768* (CAS, MEXU, NY). TAMAULIPAS: *Stanford, Retherford & Northcraft 789* (ARIZ, MEXU, NY, UC). QUERÉTARO: *Rose, Painter & Rose 9788* (MEXU, NY, US). PUEBLA: *Ripley & Barneby 14,715* (CAS, DAO, NY).

Dalea luisana (of San Luis Potosí) Wats., Proc. Amer. Acad. **17**: 341. 1882 ("*Luisana*"). — "In the San Miguelito Mountains (808, Schaffner); it is also 164 Parry & Palmer, referred to *D. wrightii*." — Holotypus, GH! isotypi, renumbered *603/808*, M, NY! — *Parosela luisana* (Wats.) Vail, Bull. Torrey Club **24**: 16. 1897; Rose, Contrib. U. S. Nat. Herb. **10**: 105. 1906.

Dalea ternata (three-parted, of the trefoil leaflets) T. Bdg., Univ. Calif. Pub. Bot. **3**: 380. 1909. — "Collected near Barranca de Tlacuilosto [near San Luis Tultitlanapa, mpo Caltepec, Puebla, near the Oaxaca boundary]. No 3214." — Holotypus, collected by C. A. Purpus in june 1908, UC! isotypi, F, NY!

The species of sect. *Cylipogon* described up to this point are characterized by pinnately 5-foliolate leaves; with *D. luisana* begins the series of species with leaves all or nearly all either pedately or palmately trifoliolate. In the latter series *D. luisana* seems most nearly related to the endemic Texan *D. hallii*, like it in the wiry, appressed-pilosulous stems and linear to linear-elliptic leaflets, but different in substantially larger flowers. The species varies little. The populations in the Tehuacán desert, although far separated from the main range of their species, are essentially typical, as already inferred by Rydberg (1920, p. 97).

157. DALEA HALLII Gray
(Plate CXXXIX)

Slender perennial herbs from an enlarged woody root, strigulose up to the inflorescence with mostly appressed, and at times a few narrowly ascending hairs up to 0.3–0.6 (0.75) mm long, the 3–several wiry, decumbent but distally incurved-ascending, purplish, sometimes minutely punctate stems 1.5–3 (4) dm long, branched throughout or only in the lower ⅔ or only distally, when depauperate simple, each branch or branchlet monocephalous, the foliage pale green, the leaflets pubescent and punctate beneath, glabrous or sometimes thinly pubescent above; *leaf-spurs* 0.5–1.2 mm long; *stipules* narrowly subulate, early becoming dry and fragile, livid-tipped, 0.5–1.3 (2) mm long; *leaves* petioled, 1.5–4.5 cm long, pedately or palmately 3-foliolate, the margined, punctate petiole 5–12 mm, the rachis 0–1.2 mm long, the leaflets linear-elliptic or linear, abruptly acuminate or acute and livid-mucronate, flat or loosely folded, dorsally carinate by the midrib, 0.8–3 (3.5) cm long, the terminal one longest, the lowest cauline and the last rameal leaves smaller, often 1-foliolate; *spikes* sessile or short-pedunculate, the peduncles not over 1 cm long, relatively few- and loosely flowered, without petals ± 14–17 mm diam, the pilosulous axis becoming 1–5 cm long; *bracts* deciduous with or soon after the petals, subhomomorphic, ovate, broadly lance- or ovate-elliptic, acute or acuminate, 4–6.5 mm long, green and thinly herbaceous except at base, ± navicular, dorsally pilosulous and punctate; *calyx* (5.1) 5.5–7.8 mm long, pilose-pilosulous with spreading hairs up to 0.8–1.3 mm long, the tube 2.4–3 mm long, recessed behind banner, the ribs becoming prominent, castaneous, the flat membranous intervals charged with 1 row of 2–3 small transparent glands, the lance-aristiform, castaneous or livid teeth (3.3) 3.7–5.2 mm long, a trifle to twice longer

than tube; *petals* yellow, seldom discolored in age, eglandular, the epistemonous ones perched near and below middle of androecium; *banner* 5–6.2 mm long, the claw 2.8–3.7 mm, the deltate-cordate blade obtuse or acute, 2.8–3.3 mm long, 3–3.8 mm wide; *wings* 4.8–6 mm long, the claw 0.8–1.4 mm, the obliquely ovate-oblong blade 3.6–5 mm long, 2.2–2.8 mm wide; *keel* 6.2–8 mm long, the claws 1.5–2 mm, the broadly ovate blade 5.2–6.4 mm long, 3.6–4 mm wide; *androecium* 10-merous, 9.5–11.5 mm long, the longer filaments free for 2.5–3 mm, the pallid anthers (0.7) 1.8–1 mm long; *pod* (of the section) ± 3 mm long; *seed* castaneous smooth ± 2.2 mm long. — Collections: 15 (i).

Gullied outcrops on calcareous or chalky prairie and rocky hillsides in oak-scrub, local and rather rare, in three small areas of e.-centr. Texas: about Dallas and Fort Worth (Dallas, Hood, and Parker cos., n. to s.-w. corner of Fannin Co.); in the hill-country near the east margins of Edwards Plateau north of Colorado River (Mills, Brown, and Comanche cos.); on and near Balcones Escarpment (Kerr, Kendall, and Hays cos.). — Flowering May to June, sometimes again August to October. — *Representative*: TEXAS. Fannin: *Turner & Tharp 3133* (TEX). Dallas: *Reverchon 4327* (NY). Parker: *Cory 58,475* (OKLA). Hood: *Tharp & Tryon 51-1096* (TEX). Mills: *Tharp s. n. in 1941* (TEX, UC). Brown: *Gladys Ellis 1* (OKLA). Comanche: *J. Bingham 42* (OKLA). Kerr: *Heller 1911* (NY, UC); *Barneby 13,540* (NY). Kendall: *Pennell 5481* (NY). Hays: *J. C. Johnson 372* (TEX).

Dalea hallii (Elihu Hall, 1822–1882) Gray, Proc. Amer. Acad. **8**: 625. 1873 ("*Hallii*"). — "On limestone, Dallas, in Northeastern Texas, Elihu Hall, 1873, no. 132." — Holotypus, GH! isotypi, NY (2 sheets), US! — *Parosela hallii* (Gray) A. Heller, Contrib. Herb. Franklin & Marshall Coll. **1**: 49. 1895.

A graceful plant, with wiry purplish stems, sparse trefoil foliage, and relatively loose spikes of large yellow flowers. The ribs and teeth of the calyx are usually red or chestnut-brown, contrasting with and not concealed by the thin vesture of spreading silvery hairs. As mentioned under the preceding species, *D. hallii* seems most nearly related to allopatric *D. luisana*, but is much larger-flowered. The members of sect. *Cylipogon* found in its range are *D. aurea* and *D. nana*, both distinguished by 5-foliolate stem-leaves.

158. DALEA PROSTRATA Ortega

(Plate CXL)

Prostrate perennial herbs with several or many slender, pliantly humifuse stems (0.7) 1–4 (5) dm long radiating from the often shallowly subterranean crown of a forking woody root (yellow beneath the bark), ± densely pilose-pilosulous almost throughout with fine straight hairs up to (0.7) 1–1.7 (2.2) mm long, the vesture variable in density and orientation, the hairs of stems varying from ascending or subappressed to vertical or subretrorse, of leaves widely ascending to subappressed, the stems very slender at base becoming stouter distally, simple and monocephalous or few-branched above middle and the lateral branchlets each monocephalous, the sessile spikes standing vertical to the ground, the foliage ± bicolored, the leaflets (dried) yellowish- or verdigris-green and either glabrous or pubescent above, sparsely punctate and more densely pubescent beneath; *leaf-spurs* 0.5–1 mm long; *stipules* submembranous, narrowly subulate to linear-lanceolate or -caudate, 2–5.5 (7) mm long, thinly pilose dorsally, becoming dry but not stiff; *leaves* petioled, 0.5–3 cm long, the petiole broadly margined, often punctate, the rachis 0.5–2.5 mm long, the leaflets

mostly 3, rarely 4 or 5, obovate to elliptic, oblanceolate, oblong, or rhombic-oblanceolate, acute, rarely linear-elliptic, obtuse and mucronulate, or (when broad) shallowly emarginate, (3) 4–20 mm long, either flat or loosely folded; *spikes* moderately dense, ovoid becoming oblong-cylindroid, without petals 1.6–2 cm diam, the ribbed, densely pilosulous axis becoming (1) 1.5–7 cm long; *bracts* subhomomorphic, deciduous at or soon after anthesis, oblong- to broadly lance-acuminate or caudate, 6–12 mm long, in lower ½–⅓ submembranous pallid navicular, embracing the calyx, thence green, livid, or purple, dorsally glabrous or thinly pilose, often sparsely gland-punctate, plumose-ciliate; *calyx* 6.3–8.6 mm long, pilose with fine straight spreading spiral hairs up to 1.5–2.3 (2.7) mm long, the tube thinly so, (2.5) 2.7–3.6 mm long, 2.8–3.5 mm diam, the ribs becoming thick and prominent, the flat membranous intervals charged with 1 row of 2–4 small, mostly transparent glands, the narrowly triangular- to lance-aristate red- or livid-tipped teeth (3.3) 3.7–5.8 mm long, stellately divergent in fruit; *petals* yellow, fading orange-brown, or (dried) pinkish-brown, eglandular, the episte-monous ones perched below middle of androecium, 1.5–4 mm above hypanthium; *banner* (4.7) 5–7 mm long, the claw (2.7) 3–4 (4.6) mm, the deltate-cordate, obtuse blade 2–3.5 mm long, 3.5–4.2 mm wide, recessed at base into a cornet; *wings* 7–8.2 mm long, the claw 2.2–2.8 mm, the obliquely obovate or oblong-elliptic blade 4.7–5.8 mm long, 2.7–4 mm wide; *keel* 8.6–11.3 mm long, the claws 2.3–3.5 mm, the broadly obliquely obovate blades (5.9) 6.3–7.8 mm long, (3.3) 3.6–4.3 mm wide; *androecium* 10-merous, 10.5–13 mm long, the longer filaments free for ± 3–4 mm, the pale anthers (0.8) 0.9–1.2 mm long; *pod* (of the section) 2.7–3.5 mm long; *seed* (seldom seen) yellow-green turning ochraceous, smooth and lustrous, 1.8–2.2 mm long; 2n = 14 (Mosquin). — Collections: 52 (vii).

Plains and hillsides, characteristically in arid grassland, 1400–2700 m (4650–9000 ft), widespread and locally abundant on a variety of volcanic and sedimentary soils around the w. and s. margins of Meseta Central, from s.-e. Chihuahua (mpos Hidalgo del Parral and V. Matamoros) s. through Durango, Zacatecas, the n.-e. arm of Jalisco, and Guanajuato to extreme n. Michoacán (near Morelia) and the Valley of Mexico (México Edo and D. F.), n. through Hidalgo and Querétaro into centr. San Luis Potosí (mpo Guadalcázar); somewhat isolated on the Gulf slope of Sierra Madre Oriental, at ± 1000 m, in s.-w. Tamaulipas (mpo. Jaumave). — Flowering July to November. — *Representative*: CHIHUAHUA: *Ripley & Barneby 13,906* (CAS, MEXU, NY). DURANGO: *Palmer 638* (F, NY, UC, US); *Gentry 6862* (F, NY). ZACATECAS: *Purpus s. n. in 1903* (UC); *Guzmán s. n. in 1959* (ENCB), AGUAS CALIENTES: *Hartweg 55* (L, NY, W); *McVaugh 23,723* (MICH). JALISCO: *Rose 2517* (NY, US). GUANAJUATO: *Ripley & Barneby 13,342* (CAS, MEXU, MICH, NY, US); *Purpus 481* (UC). MICHOACÁN: *Arsène 2476* (L, NY). MÉXICO: (Edo & D. F.): *Pringle 4483* (BR, F, M, NY, US, W, Z); *Bourgeau 71* (BR, M, P); *Balls 5589* (K, UC, US); *Rzedowski 17,112* (ENCB, WIS). HIDALGO: *Purpus 1375* (F, NY, US); *Rose & Painter 7704* (NY, US). QUERÉTARO: *Waterfall 13,928* (F, OKLA). SAN LUIS POTOSÍ: *Parry & Palmer 165* (BR, F, NY, US); *Ripley & Barneby 13,778* (CAS, NY). TAMAULIPAS: *Viereck 847, 987* (US).

Dalea prostrata (prone) Ort., Decades 69. 1798. — "*Habitat* in Nova Hispania. Floret Novembri et Decembri in Horto Reg. Matrit. e seminibus missis per *D. Sessé*." — No typus survives at MA, but the protologue decisive.

Dalea triphylla (3-leaved, the leaves 3-foliolate) Sessé & Moc. ex G. Don, Gen Hist. Dichl. Pl. **2**: 224. 1832. — "Native of Mexico...(v.s. herb. Lamb.)." — Presumed holotypus, labelled "*Dalea triphylla sp. nov. de Mexico*," OXF! probable isotypi are cited under the next. — *Parosela triphylla* (S. & M.) Macbr., Contrib. Gray Herb., New Ser. **65**: 18. 1922.

Dalea trifoliolata (with 3 leaflets) Moric., Mém. Soc. Genève **6**: 531, tab. III. 1833. — "Hab. in Mexico...J'en possède des échantillons envoyés du Mexique par M. Alaman, d'autres recueuillis par M. Berlandier, dans la vallée de Tolucca, et j'en ai recu un de M. Pavon, sous le nom de *Dalea triphylla*, ined., que j'ai cru devoir modifier." — Lectotypus, labelled "*Dalea triphylla R. & P. Nouvelle Espagne*", G! isotypus, "*Dalea triphylla* herb. Pavón", P! paratypi, "Mexique, M. Allaman, 1832", G! and *Berlandier 1214*, G, W! — *Dalea triphylla* Pavón ex Schlechtd., Linnaea **12**: 289. 1838, an illegitimate substitute for *D. trifoliolata* Moric., the supposed obstacle, *D. trifoliata* Zucc., illusory. — *Parosela triphylla* (Pavón ex Schlechtd.) Rose, Bot. Gaz. **40**: 144. 1905. *P. trifoliolata* (Moric.) Rydb., N. Amer. Fl. **24**: 98. 1920.

Over most of its range the aptly chosen epithets *prostrata* and *triphylla* (or *trifoliolata*) that have been applied to this species are tantamount to a diagnosis. In southern Chihuahua it is marginally sympatric with *D. jamesii*, distinct in its shorter, stiffer, more or less tufted stems, more silvery foliage, and yet longer calyx-teeth (cf. key to sect. *Cylipogon*, supra); and where it approaches Sierra Madre Oriental in Querétaro and San Luis Potosi it enters the range of *D. luisana*, akin but much smaller-flowered. The stems of *D. prostrata*, closely clad their whole length with short-petioled trefoil leaves, are not merely horizontally diffuse but weak and truly humifuse, radiating from a buried root-crown and winding through the grass to bear at their tips silvery-white, egg-shaped heads of plumose calyces that seem to start as it were directly from the ground.

The species varies in pubescence, in outline of leaflets, and size of bracts. Around the edge of Meseta Central from Chihuahua to Querétaro the stems are usually densely pilose with vertical or slightly retorse hairs; in the Valley of Mexico more weakly pilose. Leaflets vary from thinly pilose to glabrous on the upper face, and in outline from obovate obtuse to oblanceolate acute. The tips of the bracts may be as long or shorter than the body, and vary furthermore from pilose to glabrous dorsally and in color from pale green to livid or lively purple, when highly colored forming a sharp contrast with the clear yellow of the petals.

The identity of *Dalea prostrata*, listed by Rydberg as a doubtful synonym of *Parosela trifoliolata*, cannot be affirmed with certainty, no specimen of the original stock cultivated in the Madrid Garden having survived. However, the original description, calling for a prostrate herb with pilose stems, ternate (some 4–5-nate) leaves glabrous above, and spikes of yellow flowers subtended by concave bracts as long as themselves, answers to no other known species. The spikes were said to be *pedunculate* and *recurved*, which is not true of *D. prostrata*, though the abrupt curve of the stem which brings the head to vertical might suggest the latter character. Moricand, in any case, separated his *D. trifoliolata* because of its always ternate leaves and sessile spikes, and Macbride (1922, l. c.) raised the same points when he adopted for the species the combination *Parosela triphylla*. Since occasional 4- and 5-foliolate leaves are found in wild specimens of *D. prostrata*, the presence of a peduncle is the only discordant note in the protologue, and cannot weigh heavily against all the positive evidence. Bentham was the first (Pl. Hartw. 10. 1839), soon followed by Schauer (Linnaea **20**: 745. 1847), to voice the suspicion that *D. prostrata* and *D. trifoliolata* were one and same, and in the context of contemporary knowledge of sect. *Cylipogon* it seems virtually certain. All of the names proposed for the species rest ultimately on specimens or progeny of seeds sent to Madrid by Sessé, who is not known to have encountered any other member of the group.

159. DALEA JAMESII (Torrey) Torrey & Gray
(Plate CXL)

Low, loosely tufted perennial herbs from a thick woody root and knotty or shortly forking caudex, up to the pilose-barbate inflorescence densely silky-pilose or -pilosu-

lous with narrowly ascending and subappressed (rarely a few spreading) hairs up to (0.5) 0.7–1.3 mm long, the 1–7, rarely up to 15 stems excluding the solitary terminal spike 1–10 (13) cm long, when short erect or nearly so, when longer decumbent and incurved distally, simple or spurred at base, the foliage silvery (rufescent when dried), the leaflets equally pubescent both sides, pungently oil-scented when crushed but not visibly glandular; *leaf-spurs* 0.5–1 mm long; *stipules* narrowly lance-acuminate, (1) 2–6 mm long, becoming pallid except for red or livid tips, stiff and fragile, subglabrous or thinly pilosulous; *leaves* (0.6) 1–3 (4) cm long, petioled, palmately 3-foliolate, the narrowly winged, sometimes minutely punctate petiole (3) 5–15 (18) mm long, the leaflets obovate to broadly oblanceolate, obtuse but often penicillate-acute, flat or loosely folded, (3) 5–18 mm long, the terminal one commonly longest, all carinate dorsally by the midrib; *spikes* sessile or nearly so, moderately dense, without petals (16) 18–23 (25) mm diam, the pilosulous axis becoming 1.5–6.5 (8) cm long; *bracts* deciduous at or soon after anthesis, lance-oblong- or narrowly obovate-acuminate, (4) 5–8 (9) mm long, at base embracing the calyx, thinly pubescent but eglandular dorsally, the lower ones firm, green or lurid, the upper submembranous, purplish or lurid beyond the pallid base; *calyx* (8.3) 8.5–12 (13.3) mm long, pilose with spreading spiral hairs up to 1.3–2.3 mm long, the tube (2.4) 2.8–3.5 mm long, somewhat recessed behind banner, the castaneous ribs becoming prominent, the flat membranous intervals charged with 1 row of 3–4 tiny transparent glands, the deltate- or triangular-aristate teeth (5) 5.5–9 (10) mm long, not gland-spurred; *petals* clear yellow, fading orange-brown, often glandless, the epistemonous ones perched below middle of androecium; *banner* 5.2–6.6 mm long, the claw 2.6–3.5 mm, the usually deltate-cordate, subacute, spade-shaped blade 3.2–4.2 mm long, 3.2–4.4 mm wide; *wings* 5.3–6.8 mm long, the claw 1.4–2.1 mm, the obliquely ovate-oblong obtuse blade 3.9–5.1 mm long, 2.3–3.2 mm wide; *keel* (6.3) 6.5–8.6 mm long, the claws 1.5–2.8 mm, the obliquely obovate blades 5.3–6.3 mm long, 3.2–3.8 mm wide; *androecium* 10-merous, (9.5) 10–11.7 mm long, the longer filaments free for 1.7–3 mm, the pallid anthers (0.8) 0.9–1.2 mm long; *pod* (of the section) 3.5–4 mm long; *seed* castaneous, lustrous, 2.3–3 mm long; n = 7 (Spellenberg, 1973). — Collections: 86 (viii).

Stony hillsides, plains, and gullied breaks on short-grass prairie, on a variety of eruptive and sedimentary strata, mostly between 925 and 2100 m (3100–7000 ft), widely dispersed and locally common nearly throughout the valley of Pecos River in e. New Mexico and w. Texas (e. to Crockett Co.), n. through the Texas and Oklahoma panhandles to the Arkansas valley in Colorado and adjacent Kansas, in New Mexico extending w. feebly into the middle Rio Grande valley at Santa Fe and more abundantly across the southern tier of counties to the edge of the Gila Basin in s.-e. Arizona (to Santa Cruz and Pima cos.; to be expected in extreme n. Sonora), and from trans-Pecos Texas s. in scattered stations through e. Chihuahua as far as Hidalgo del Parral. Flowering April to August n.-ward, often again in fall in Mexico and Arizona. — *Representative*: UNITED STATES. COLORADO: *Osterhout 2034* (NY); *Clokey 3801* (UC); *Barneby 14,992* (CAS, NY). OKLAHOMA: *Waterfall 10,725, 14,906* (OKLA). TEXAS: *Cory 53,410* (NY); *Earle & Tracy 341* (NY, W); *Correll & Johnston 21,995* (RENNER); *Ripley & Barneby 7509* (CAS, NY). NEW MEXICO: *Fendler 133* (L, NY, OXF, UC, US, W); *Barneby 13,829* (NY); *T. & L. Mosquin 5730* (NY); *Metcalfe 92* (OKLA, NY, UC, US). ARIZONA: *B. & R. Maguire 11,681* (NY, UC); *Thornber 4398* (OKLA). MEXICO. CHIHUAHUA: *Correll & Johnston 21,688* (RENNER); *Ripley & Barneby 13,907, 13,930* (NY).

Dalea jamesii (Torr.) T. & G., Fl. N. Amer. **1**: 308. 1838, based on *Psoralea jamesii* (Edwin James, 1797–1861) Torr., Ann. Lyc. Nat. Hist. N. Y. **2**: 175. 1827 ("*Jamesii*"). — "Sandy plains of the Canadian." — Holotypus, collected by Dr. James in 1820, NY (herb. Torr.)! — *Jamesia obovata* Raf., Atl. Jour. 145. 1832, an illegitimate change of epithet. *Parosela jamesii* (Torr.) Vail, Bull. Torrey Club **24**: 16. 1897.

Parosela porteri (Thomas Conrad Porter, 1822–1901) A. Nels., Bot. Gaz. **31**: 395. 1901 ("*Porteri*"). — "Collected at Berwind [Huerfano Co.], Colorado, 1900, by *Jennie M. Archibald*, no. 244." — Holotypus, WYO!

A neatly attractive dalea, in stature and in the relatively emormous but not extremely dense spikes of long-toothed calyces similar to *D. wrightii* and often confused with it, mixed collections being not infrequent in herbaria. In western Texas and adjoining states *D. jamesii* is sympatric not only with *D, wrightii* but also with *D. nana*, but is readily distinguished from both by its trifoliolate cauline leaves; furthermore from *D. nana* in its much larger long-toothed calyx and from *D. wrightii* in the ample blades of the short-stalked banner and low-perching keel. The close affinity of *D. jamesii* is with *D. prostrata*, from which it differs in the short, firm stems, silvery appressed pubescence of the leaves, and greatly elongated calyx-teeth. These two species are almost entirely allopatric, and where their ranges converge in southern Chihuahua remain as sharply distinct as elsewhere.

Apart from expectable variation in development of stem and length of spike, *D. jamesii* is virtually monomorphic. The description of *Parosela porteri* derives from a misconception: that it was the *Dalea jamesii* described by Porter & Coulter in their Synopsis, but not the original plant described by Torrey. In Colorado *D. jamesii* is known on reliable evidence to extend no further north than the Arkansas valley, and no higher in the foothills of the Rocky Mountains than ± 6600 ft (1980 m), but is reported by Harrington (Man. Pl. Colo. 326) from central Colorado and up to 9000 ft. A specimen at NY (*Brandegee 188*) labelled "Breckenridge, 9700 ft" is perhaps associated with the wrong data. The locality, high on the west slope in Summit County, is not necessarily impossible, for islands of prairie vegetation do occur high on the flanks of the Rocky Mountains, but requires verification. Elsewhere *D. jamesii* extends west of the Continental Divide only by the well-known route of migration around the south end of the Mogollon Mountains into the edge of the Gila Basin.

160. DALEA LANICEPS Barneby

(Plate CXLI)

Diminutive loosely tufted perennial herbs from a slender but woody root, including the inflorescence 2.5–8 cm tall, the 1–3 sometimes 5, erect or incurved-ascending, densely leafy stems simple and monocephalous, 0.5–4 cm long, the foliage silvery-pilose with straight subappressed and narrowly ascending hairs up to 1–1.5 mm long, the leaflets equally pubescent both sides, aromatic when crushed but not visibly glandular; *leaf-spurs* up to 2 mm long; *stipules* linear-caudate, yellowish with red or livid tips, becoming stiff and dry; *leaves* petioled, (1) 1.5–3.5 cm long, all pinnately 3-foliolate, the rachis 0.5 –3 mm long, the leaflets rhombic-ovate to elliptic-oblanceolate, obtuse or subacute, flat, 5–18 mm long, the terminal one longest; *spikes* terminal, sessile, nestling among the leaves, plumply ovoid, ovoid-oblong, or subglobose, very densely many-flowered, without petals 1.5–2 cm diam, the axis 0.7–3 (3.5) cm long; *bracts* deciduous only with the ripe pod and calyx, dimorphic, the lowest broadly

obovate, short-acuminate, flat, thinly herbaceous becoming papery, 6–9 mm long, 3.5–5 mm wide, the interfloral ones nearly as long but much narrower, elliptic-acuminate, ± folded, membranous at base, all pilose dorsally, glandless or charged with a few small immersed glands; *calyx* 7.8–8.7 mm long, densely pilose with stiffly ascending, finally spreading spiral hairs up to ± 2 mm long, the tube 2.5–2.9 mm long, shallowly recessed behind banner, the ribs green, slender, the membranous flat intervals charged with 1 row of 2–3 small transparent glands, the triangular-aristate teeth 4.9–6.2 mm long, red-tipped, plumose; *petals* clear yellow fading reddish-brown, sometimes pinkish when dried, glandless, the epistemonous ones perched above middle of androecium; *banner* 7–8.2 mm long, the slender claw 5–5.8 mm, the reniform emarginate or obtuse blade 1.8–2.4 mm long, 1.9–2.8 mm wide; *wings* 2.8–3.2 mm long, the claw 0.5–0.6 mm, the obliquely ovate blade 2.4–2.7 mm long, 1.2–1.4 mm wide; *keel* 4.5–5 mm long, the claws 1.2–1.6 mm, the oblong or ovate-oblong blades 3.2–4 mm long, 1.6–2 mm wide; *androecium* 10-merous, 10–11 mm long, the longer filaments free for 1.2–1.6 mm, the greenish-blue or pinkish anthers 0.5–0.6 mm long; *pod* (of the section) ± 2.5 mm long; 2n = 14 (Mosquin). — Collections: 17 (vii).

Open stony hills and gullied knolls, in caliche desert, open pinyon-forest, and grama grassland, mostly between 900 and 2430 m (3000–8100 ft), local and occurring as widely scattered individuals, but inconspicuous and probably much overlooked, radiating from Coahuila into n. San Luis Potosí (mpo Charcas), n. Zacatecas (mpo Sombrerete), n.-e. Durango (mpo Villa Hidalgo), s.-centr. and e.-centr Chihuahua (mpos Hidalgo del Parral, Allende, and Manuel Benavides), and trans-Pecos Texas (Pecos, Brewster, and Terrell cos). and e. out onto the first piedmont of Sierra Madre Oriental in n.-e. Nuevo León (mpos Cerralvo and Dr. González), there descending (on limestone) to ± 250 m. — Flowering late June to November. — *Representative*: UNITED STATES. Texas: *Turner 5120* (TEX); *Warnock 13,452* (RENNER). MEXICO. Chihuahua: *R. M. Stewart 2530* (GH); *Ripley & Barneby 13,905* (CAS, MEXU, MICH, NY, US), *13,928* (DAO, NY). Coahuila: *Wynd & Mueller 456* (ARIZ, NY, OKLA); *I. Johnston 9165* (GH); *Ripley 14,962* (NY). Nuevo León: *Ripley & Barneby 13,249* (CAS, MEXU, NY, US), *13,549* (CAS, MEXU, MICH, NY, US). Durango: *Ripley & Barneby 13,955* (CAS, NY). Zacatecas: *Ripley & Barneby 14,152* (DS, NY). San Luis Potosí: *Lundell 5091* (MICH).

Dalea laniceps (with woolly heads) Barneby, Southwest. Nat. **15**(3): 390. 1971. — "...MEXICO...Nuevo León: 16 miles SW of Cerralvo, at Arroyo del Fraile, Oct 27, 1964, *Ripley & Barneby 13,547*..." — Holotypus, NY! isotypi, CAS, GH, K, MEXU, MICH, SMU, US!

The smallest and most highly modified member of sect. *Cylipogon*, combining on a condensed scale the silvery trefoil foliage of *D. jamesii* with the long-clawed banner and tiny, high-perching keel of 5-foliolate *D. wrightii*. The plant forms a diminutive tuft of leaves among which nestle the few or often solitary, proportionately enormous globes or squat cylinders of barbate calyces. An interesting feature is the dimorphism of the bracts, the broad, plane or shallowly concave lowest ones forming a sort of calyculus under the spike, the interfloral ones much narrower and pleated proximally. In Coahuila and neighboring Texas and Nuevo León *D. laniceps* is markedly calciphile, but in Zacatecas has been found on volcanic and metamorphic gravels.

The earliest collection of *D. laniceps* known to me was made near Saltillo, Coahuila in June, 1898, by Edward Palmer (no. *249*, p. p., mixed with *D. nana* var. *carnescens*, US). The sheet of specimens was seen by Rydberg who recognized the mixture but misidentified the *laniceps* element as *D. jamesii*.

V. Subgenus ASPROLEA Barneby

Leaves pinnately 3-foliolate, the large, suborbicular leaflets incipiently peltate at insertion of petiole and pinnately nerved; *spikes* loose, elongate; *bracts* very large, persistent, membranous-margined, enfolding and almost concealing the calyx; *petals* yellow, unchanged in fading, the banner and keel of ± equal length, the banner open at base, the keel-blades (of subgen. *Parosela*) valvately coherent and enclosing the androecium; *pod and seed* very large, the latter ± 4 mm long. Shrubs (?) or perhaps tall herbs; s. Mexico, monotypic.

Dalea subgen. **Asprolea** Barneby, subgen. nov. — Folia pinnatim 3-foliolata, foliolis magnis subpeltatis pinnatim venulosis; spica elongata laxa, calycibus bractea persistenti ampla latissime membranaceo-marginata grosse glandulosa obtectis; petala lutea post anthesin colore immutata; legumen semenque generis maxima, hoc ± 4 mm longum. — Sp. unica: **D. trifoliata** Zucc.

161. Dalea trifoliata Zuccarini
(Plate CXLII)

Probably shrubby or suffrutescent but habit and full stature not known, glabrous to the inflorescence, the rather stout stems pallid, striate, sparsely gland-tuberculate, the foliage thick-textured, glaucescent, the leaflets smooth above, prominently micro-tuberculate-glandular beneath; *leaf-spurs* almost 0; *stipules* less than 1 mm long, broader than long, very obtuse, their membranous margins minutely crenulate; *intra-* and *post-petiolular glands* very small, scarcely prominent; *leaves* 3–7 cm long, 3-foliolate, the angled but scarcely winged petiole 1.2–2.5 cm long, the leaflets broadly ovate to suborbicular, deeply emarginate, 1.2–2.7 cm long, 1–2.3 cm wide, the terminal one separated from the pair by a rachis 7–14 mm long, the blades obscurely peltate, flat, the margins shallowly gland-crenulate, the midrib prominent beneath and running out into a small terminal gland, the secondary venation pinnate; *spikes* pseudoterminal, relatively loose, the flowers (3-ranked, acc. Zuccarini) ascending, sessile, the pilosulous axis 3–10 cm long; *bracts* persistent, broadly obovate, deeply emarginate, embracing the calyx, 4.5–6.5 mm long, in profile 2.5–3.7 mm wide, thinly papery and dorsally pilosulous (the lowest glabrate), with broad, glabrous, hyaline margins, charged dorsally with 1–4 smaller and 1–2 larger, or 3 large, elongately elliptic, brown or livid blister-glands; *calyx* 6.5–6.7 mm long, the tube 3.7–4.5 mm long, shallowly recessed behind banner, thinly pilosulous between the thick, glabrous, castaneous ribs, the hyaline intervals broad, charged with 1 row of ± 5 small glands, the teeth triangular-ovate, bluntly gland-mucronate, a little unequal, the dorsal one 2.2–2.8 mm long, all plumose-ciliate and pilose within with spreading straight spiral hairs up to 0.7–1 mm long, each tooth charged on each side with 2–4 gland-spurs; *petals* sulfur-yellow, not rubescent in age, the banner with a radiating fan of purplish striae, all charged with a large, prominent, livid-castaneous, subapical blister-gland, the inner ones perched ± 2–2.5 mm above hypanthium, the keel-blades coherent distally; *banner* nearly erect, 8.5 mm long, the fleshy, trigonous claw 2.6 mm, the cordate, hooded blade 6.8 mm long, nearly as wide; *wings* 6.7 mm long, the broad claw 1.7 mm, the obovate, shallowly emarginate blade 5.6 mm long, 3.8 mm wide; *keel* 8.4 mm long, the claws 1.5 mm, the broadly obovate blade 7.5 mm long, 5 mm wide;

androecium 10-merous, ± 10.5 mm long, the longer filaments free for nearly 3.5 mm, the connective tipped with a small dark gland, the anthers 1.2–1.4 mm long; *pod* ± 5 mm long, harp-shaped in profile, the style-base lateral, the leading edge strongly carinate, the valves papery but not hyaline at base, with a few prominent anastomosing veins and a sprinkle of minute fuscous glands, coarsely pilose in the upper ¼ with stiff ascending hairs up to 0.8–1 mm long; *seed* compressed, castaneous, ± 4.2 mm long. — Collections: 2 (o).

Habitat and dispersal unknown, but to be sought in desert lowlands of Oaxaca, perhaps in the basin of upper Río Papaloapan on the Caribbean slope. — Flowering in winter, December and probably later. — *Material*: MEXICO, sine. loc., cult. in Hort. Reg. Monac. (type). Oaxaca: San Carlos. Corral de Piedras (Partido Quilchapan), Dec. 1842, *Liebmann 4567* (F, US "*4597*", presumed duplicate).

Dalea trifoliata (with trefoil leaves) Zucc., Abh. Akad. Wiss. München **1**: 343. 1832, and Flora (Regensb.) **15**[2]: Beibl. 69. 1832. — "Crescit in imperio mexicano, unde semina misit clar. de Karwinski." — Holotypus, cult. in hort. monac., dated 1834, M! — *Dalea zuccarinii* Walp, Rep. **1**: 654. 1842, a superfluous substitute, the supposed obstacle being *D. trifoliolata* Moric., of significantly different form.

The truly extraordinary, taxonomically isolated *D. trifoliata* is so richly endowed with unusual features that Rydberg (1920, p. 116), who knew it only from the protologue, declined to assimilate it into *Parosela*, suggesting instead that it should be compared with *Psoralea melanocarpa* Benth. Study of actual specimens shows that Rydberg's suspicions were ill-founded, the flower-structure of *D. trifoliata* being unexceptional in its genus. However the pinnately trifoliolate leaves, the large round pinnately nerved leaflets of thick texture crenulate around the margin by impressed glands, the open spikes of large persistent membranous-margined bracts, all contribute to an unique facies. The relatively great size of pod and seed and the apparently thick-textured, permanently yellow petals are hardly less curious. The species has no obvious relatives.

Although collected twice in the first half of XIX century *D. trifoliata* has not been encountered since, and nothing is on record about its habitat. Liebmann's locality in Oaxaca has not been identified from modern maps, and the source of the seeds from which the plant was grown at Munich was never specified exactly. Although the extant specimens show only upper stems, and give no real information about the plant's stature or habit of growth, their general appearance suggests a specialized xerophyte of a sort to be expected in drought-deciduous thorn-forest. From what little is known of Karwinski's and Liebmann's movements in Mexico it seems at least probable that both travelled the old highway, now followed by the railroad but hardly accessible otherwise in modern times, that leads from Tehuacán to Oaxaca via Cuicatlán and Tomellín canyon. This trail traverses a strip of subdesertic vegetation along the upper forks of Río Papaloapan which remains little known, and it is here that *D. trifoliata* should be sought.

APPENDIX I: SPECIES INCERTAE SEDIS IGNOTAEQUE

Dalea antana Macbr., Field Mus., Bot. **13**[3]: 365. 1943. — "Cuzco: Limatambo, Prov. Anta, 2,700 meters, *Vargas 502*, type." — Holotypus, collected in April, 1937, F! = *NY Neg. 8601*.

The holotypus of *D. antana* consists of two stems severed at points about 1.5 dm below the panicle of 3–4 spikes. A field note calls the plant herbaceous, but tells nothing of stature. The plant's aspect immediately suggests *D. smithii* and *D. pazensis*; it must be closely akin to both but fits neither in fine detail. The leaves and stems are pilosulous with rather stiff ascending hairs up to 0.5–0.6 mm long, and the flowers (poorly preserved

and perhaps none fully expanded) appear to be smaller (keel-blade ± 4.5, not 5+ mm long) than at least average examples of the relatives mentioned. The bracts are persistent between flowers well past anthesis, and for this reason *D. antana* would pass readily for a minor pubescence-variant of *D. pazensis*, if it occurred within the range of that species. Except for the persistent bracts it would be absorbed, with the same reservation as to vesture, in sympatric *D. smithii*. The village of Limatambo lies on the highway between Cuzco and Abancay a few kilometers east of the Apurimac River crossing. A moderately pubescent phase of *D. smithii* occurs within 30 kilometers distance on the west bank of the river in Abancay (Curahuasi). Relatively glabrous and pubescent phases of *D. smithii* are already known, and one more densely pubescent with longer hairs would not be unexpected; but not with persistent bracts. Conceivably *D. antana* represents a pilosulous phase of *D. pazensis* introduced along the highway from further south, one not yet exactly matched for vesture in collections from Bolivia. Until more can be learned of *D. antana* and sympatric *D. smithii* in the upper Apurimac valley and complete specimens showing the rootstock and fully expanded flowers are available for comparison, no taxonomic disposition will be possible. The sympatric *D. boliviana*, although resembling *D. antana* in persistent bracts, seems safely distinct in the fewer leaflets.

Dalea flavo-rosea Mociño & Sessé ex DeCandolle, Prod. **2**: 246. 1825. — "...in Mexico." — Holotypus: the copy at G of the original, lost plate of *D. flavo-rosea* M. & S.

DeCandolle's description was based entirely on the plate, and no definite connection can be established between this and any surviving specimen. Said to be an erect subshrub with five pairs of oval, obtuse, velvety-pubescent leaflets, ovate, pedunculate spikes, and bicolored flowers, these, on the evidence of the "calque" of a type prevalent in sect. *Parosela* ser. *Tuberculatae*. Two species of the group are known to have been collected by the botanists of the expedition to New Spain: *D. bicolor*, represented by the holotypes of *D. verrucosa* G. Don and *D. laevigata* G. Don (OXF), and *D. minutifolia*, in herb. Sessé & Mociño (*no. 2667 bis*, MA). The latter species, characterized by 2–4 (5) pairs of extremely small, usually quite glabrous leaflets can hardly be equated with *D. flavo-rosea*. If one could assume that specimens of *D. flavo-rosea* survive, it would be safe to identify it with some form of the polymorphic *D. bicolor*, but no such an assumption can be made. An attempt to match *D. flavo-rosea* with a posthumous description by Sessé & Mociño has not succeeded. The *Psoralea* most like it is *Ps. purpurea* S. & M. (discussed below), which had 13 leaflets and bicolored (yellow and purple) flowers; but the foliage is described as glabrous. I am unable to identify *D. flavo-rosea* from the plate alone.

Dalea hypoglottidea DeCandolle, Prod. **2**: 245. 1825. — "...in Mexico." — Holotypus: the copy at G of the original, lost plate of *Dalea astragalina* Sessé & Mociño (non *D. astragalina* H. B. K.).

The binomial *D. astragalina* (or the epithet in another generic setting) has not been found in connection with any surviving specimen from the Sessé, Mociño and Maldonado collection from Nueva España; in consequence identification of *D. hypoglottidea* depends entirely on interpretation of the "calque" and accompanying description made presumably from the original drawing. The plant should be diffuse, glabrescent, with 11–13 pairs of leaflets, and "lateral" (i. e. leaf-opposed), long-pedunculate, ovoid spikes of purple flowers. Because of the high number of leaflets, *D. hypoglottidea* cannot be equated with any *Psoralea* described posthumously from Sessé's manuscripts other than *Ps. polystachya*, of which a specimen does survive in herb. Sessé & Mociño (MA; cf. *Dalea polystachya* of this account). I have not felt convinced of the identity of the two proposals, and therefore must list *D. hypoglottidea* as an unsolved problem.

Dalea lachnantha Schauer, Linnaea **20**: 743. 1847. — "In graminosis montanis provinciae Oaxacanae. *Aschenborn n. 274.*" — Holotypus, formerly at B, destroyed; no isotypus found.

This species was described in great detail and ought to be recognizable. Except that the plant is said to be suffruticose (but the stem seen was only a span long, and the root may have been lacking), every detail of the protologue is in accord with *D. brachystachya* Gray (1853), the "inconspicuous corolla, whitish-yellowish when young, lurid in age" being especially suggestive, and the "filiform diffuse stems" counterbalancing the suggestion of woodiness. The known southern limit of *D. brachystachya* is the Tehuacán desert in southern Puebla, but it could very well extend south into the floristically related arid interior of Oaxaca. Search in Germany may yet uncover an isotypus and restore to currency what seems almost certainly the oldest name for some southern Mexican dalea.

Dalea moricandi D. Dietr., Syn. Pl. 1015. 1847. — "In Amer. austr." — No collector cited; no specimen seen.

The description calls for an erect, profusely branched shrub with pubescent, tuberculate branches and leaves with about seven obovate, gray-tomentose, somewhat glandular leaflets; short terminal spikes; a villous calyx. It applies, so far as it goes, to *A. carthagenensis* var. *trichocalyx*, but neither decisively nor exclusively. Most Andean daleas have more than three pairs of leaflets on primary leaves, but in the drought phase may appear to have fewer. The species cannot be identified unless a typus can be located.

Dalea pedunculata Pursh, Fl. Amer. Sept. 474. 1814. — "On the banks of the Mississippi. Enslen...v.s. in Herb. Enslen." — No typus known to survive. — *Psoralea pedunculata* (Pursh) Poir. in Lamk., Encycl. Méth. **4**: 590. 1816.

A vexatious mystery, which ought to be soluble but has resisted all efforts. Enslen's herbarium (Wood in Jour. Arnold Arb. **47**: 94. 1966) is scattered, elements of it being housed at Wien, others in the Barton herbarium at Philadelphia (perhaps derived from herb. Pursh.), and others dispersed with that part of Pursh's herbarium that was not bought in at the Lambert sale for return to America. My colleague Eugene Jablonski searched the Wien herbarium without success, and nothing has been located at PH. It seems rather likely that the actual typus was the Enslen specimen seen by Gray at Boyton before Lambert's death and cited (in T. & G., Fl. N. Amer. **1**: 308): "...perhaps collected in Georgia... labelled *D. alopecuroides*; but with spikes...only 6–8-flowered, and on very long peduncles." It seems hardly possible that Enslen could have collected *two* unidentifiable daleas in southeastern United States, and it seems legitimate to admit Gray's remark as evidence bearing on the identity of *D. pedunculata*.

Turning back to the protologue one finds that *D. pedunculata* was "glabriuscula," presumably not fully glabrous (like *D. leporina*), had short spikes elevated on axillary peduncles thrice the length of the leaf; minute bracts *as long as the pedicels*; subulate calyx-teeth; *pink* petals; and *about six pairs* of linear, acute and mucronate leaflets. Traditionally *D. pedunculata* has been treated as a synonym, probable, possible, or finally assured, of *D. leporina* (or the equivalent *D. alopecuroides*), but the protologue, even allowing for one or two Purshian inaccuracies, simply cannot be stretched to allow this interpretation. Any form of *D. leporina* that could have been encountered (except as a waif) by Enslen must have had at minimum eight pairs of leaflets and these obtuse or emarginate, sessile flowers subtended by a bract as long as the calyx, proportionately shorter peduncles, and white flowers. Assuming for the sake of argument that Gray saw genuine *D. pedunculata*, it is unlikely that the plant belonged to a different genus, like *Dalea parviflora* Pursh, which is an *Astragalus*; so gross an error at the level of genus could not have gone unnoticed. If really *Dalea*, and really collected on the lower Mississippi by Enslen, the choice of possibilities is extremely narrow: *D. emarginata*, which follows the Gulf Coast east into western Louisiana; *D. carnea* var. *gracilis* which follows the Coast west as far as Lake Pontchartrain; or of course the unpredictable joker of a weed on the New Orleans waterfront. The native species both disagree with the protologue in having sessile flowers, but the bracts of *D. carnea* var. *gracilis* are at least relatively very small.

It is a tempting hypothesis to equate *D. pedunculata* with *D. emarginata*. Torrey & Gray (Fl. N. Amer. **1**: 311) remark on the similarity between their *Petalostemon emarginatum* and *Dalea alopecuroides*, and the leaflet-number and long-pedunculate spike compare favorably, as do the pink flowers. But the leaflets of *D. emarginata* could never have been described as linear, acute, mucronate, when they are notably emarginate or retuse.

In leaflet-shape, but not in number the protologue of *D. pedunculata* coincides pretty well with *D. carnea* var. *gracilis*, which may have the proportionately long peduncles and has characteristically a short, few-flowered spike that could match Gray's note on the plant in herb. Lambert. But the flowers of var. *gracilis* are white, not pink, and the leaflets at most three pairs. If the phrase in the protologue "foliis subsexjugis" could be modified to "foliis subsexfoliolatis" (a confusion between number of leaflets and number of leaflet-pairs is widespread in the literature of Leguminosae), the only discordant note of real substance between var. *gracilis* and *D. pedunculata* would be the pedicelled flowers. If there were pedicels, and the plant was a *Dalea*, it cannot have been other than an introduced weed.

Dalea querceti Harms, Verh. Bot. Ver. Brandenb. **65**: 89. 1923. — "Habitat in Guatemala, juxta urbem Guatemala, in querceto, in barranca del Zapote: Seler n. 2489." — Holotypus, formerly B, destroyed; no isotypus found.

Described in full detail and likened by Harms to *D. psoraleoides* Moric., differing from that and from closely related *D. tomentosa* Cav. in its greener foliage. The only dalea known from Guatemala with externally glabrous and at same time short-toothed calyx combined with 2–6 pairs of relatively large leaflets is *D. tomentosa* var. *psoraleoides* (Moric.) Barneby, to which *D. querceti* is most probably referable. The type-locality is so easily accessible that topotypes might most appropriately settle the question of synonymy.

Dalea selerana Harms, Verh. Bot. Ver. Brandenb. **65**: 89. 1923 ("*Seleriana*"). — "Habitat in Mexico, in prov. Oaxaca, in distr. Nochistlan apud San Pedro Quilitongo: Seler n. 1526." — Holotypus, formerly B, destroyed; no isotypus found.

The species was described as akin to *D. lasiostachya* Benth. (*D. versicolor* var. *involuta* of this account) but more particularly to that entity as represented by *Pringle 6074* from Sierra de San Felipe near Oaxaca, which is *D. versicolor* var. *versicolor*. From this it is said to differ in its more copious pubescence, a very variable feature in the races of *D. versicolor* found in the Mixtec highlands. I suppose, but cannot be positively sure, that *D. selerana* represents a form of *D. versicolor* var. *versicolor*.

Petalostemon amethystinus Schott, "Wien. Zeitschr. **4**: 1216. 1830" reprinted by Endlicher, Linnaea **6**, Litteratur: 55. 1831. — "Brasilia." — No collector mentioned, and no matching specimen found either in Wien or Budapesth.

This name is of obvious potential importance because of its early date, but its application remains entirely obscure. My colleague Eugene Jablonski searched the Austro-Hungarian herbaria in vain for authentic material; perhaps it exists but has been reidentified and moved to another genus. No true *Petalostemon* could be expected from Brazil, and indeed no Amorpheae of any sort are reported from that country; the protologue must be in error somewhere, but as the description would apply very well to some species of *Dalea*, it may be the type-locality that is at fault. Significant details from the description are: an erect, sulcate stem; 4–5 pairs of linear, nearly glabrous leaflets glandular beneath; subsessile conelike spikes; bracts longer than the plumose-hirsute calyx, which is cleft over half way into lance-acuminate teeth; long-clawed petals, the banner whitish, the wings and keel violet. Except that only the banner is really long-clawed, *D. cliffortiana* fits the description neatly. It is even possible that this weedy species, which has become established in several places outside of its primarily Mexican range, was at one time a short-lived visitor in Brazil.

Petalostemon virgatum Nees & Schweinitz, [Maximilian zu Wied] Neuwied, Reise Nordamer. **2**: 432. 1840. — No locality given, but presumably encountered somewhere in Missouri valley between its mouth and central Montana.

Fully described, but the exact application of the name remains uncertain, no authentic material having survived, and no precise locality being on record. The protologue forcibly suggest one or other of the two varieties of *D. candida*, the only white-flowered petalostemon that could have been encountered along Maximilian's route. The species was said to differ from *D. candida* in its short floral bracts, concealed under the calyces, which are said to be either glabrous or minutely puberulent. The hidden bracts suggest var. *candida*, but the sometimes puberulent calyx points rather to var. *oligophylla*, to which (as *P. occidentalis*) it was referred, with mark of interrogation, by Wemple (1970, p. 43). Since Maximilian's party ascended (1833–4) the Missouri River from St. Louis as far upstream as the mouth of Marias River in the present Chouteau County, Montana, both varieties lay in their path. The herbarium of Nees von Esenbeck, where a type might have been preserved, is said to have been lost at BONN in 1944.

Psoralea laevigata Sessé & Mociño, Pl. Nov. Hisp. 120. 1889. — "Habitat in Sancti Hieronymi montibus in ditione Chilapae [Guerrero]."

Described as a shrub reaching five feet in height, with smooth, dark purple branchlets, 7-flowered racemes, and purple flowers with white banner, in all details agreeing with *Marina diffusa* var. *diffusa*, which was described (as *Dalea diffusa*) from specimens probably collected by Sessé and distributed by Pavón. It seems highly probably that *Ps. laevigata* and *D. diffusa* were based on parts of one collection, but it is impossible to demonstrate any firm connection between the two. Because *M. diffusa, M. nutans,* and *M. scopa* are not easily distinguished in written words I cannot claim to be on firm ground in the identification of *Ps. laevigata* and therefore list it in this Appendix rather than in the text.

Psoralea purpurea Sessé & Mociño, Fl. Mex. ed. 2, 169. 1894; Fl. Mex. 185. 1896. — "Habitat in aridis et arenosis Sancti Angeli agris [= San Angel, D. F.]." — Non *Ps. purpurea* (Vent.) Poir. (1804).

The protologue paints a convincing portrait of a dalea, but I am unable to recognize the species. A glabrous herb with procumbent stems, red distally, leaves pinnately 13-foliolate (leaflets obovate); dense oblong spikes borne leaf-opposed and terminally, bracts ovate concave punctate and long-acuminate, calyx densely villous and glandless, and bicolored flowers with yellowish banner and purple keel. If native at San Angel, the choice of candidates is limited and none fills the bill. The habit suggests *D. hegewischiana*, but this has a glabrate, conspicuously glandular calyx. The villous calyx might be that of *D. versicolor* var. *involuta*, but obovate leaflets and long-acuminate bracts forbid this interpretation. The bracts suggest *D. obovatifolia*, but this seldom has more than eleven leaflets and the calyx is at best only thinly pilose. There is an extant specimen (OXF) probably derived, through Pavón and Lambert, from the Nueva España collections and annotated *Dalea purpurea*; but this is *Marina nutans*, which has a glabrous, conspicuously punctate calyx. In absence of matching specimens, the identity of *Ps. purpurea* seems to present an insoluble puzzle.

Psoralea sericea Sessé & Mociño, Fl. Nov. Hisp. 121. 1889. — "Habitat in Zitlatae montibus [Guerrero]."

There is a specimen in the Sessé & Mociño herbarium (*no. 2658*, MA) labelled *Psoralea sericea* nob. which appears to validate the name. But the plant is actually *Dalea sericea* Lagasca and does not accord well with the protologue of *Ps. sericea*. The latter is said to be suffruticose, two foot tall, with erect, alternate, silky-tomentose branchlets,

7–9 elliptic leaflets silky both sides, terminal conic spikes, and very small purplish flowers scarcely longer than the calyx. This description agrees better with *D. tomentosa* var. *psoraleoides*. Sessé & Mociño knew *D. sericea* Lag. as *Psoralea alopecurus*.

APPENDIX II: NOMINA NUDA

Dalea adenophylla Moricand ex Rydberg, N. Amer. Fl. **24**: 109. 1920, in syn. (*Parosela zimapanica*). — Moricand actually wrote "*adenopetala*".

Dalea agavacensis Humboldt & Bonpland ex Steudel, Nom. ed 2, **1**: 480. 1840. sphalm. pro *D. ayavacensi*.

Dalea alba Michaux ex Roemer, Cat. Hort. Bot. Soc. Phys. Turic. 1802.

Dalea astragalina Mociño & Sessé ex DeCandolle, Prod. **2**: 245. 1825 (*D. hypoglottidea*).

Dalea flava Mociño & Sessé ex DeCandolle, Prod. **2**: 245. 1825 (*D. lutea*).

Dalea guatemalensis Bentham ex Hemsley, Biol. Centr.-Amer., Bot. **1**: 241. 1880, nomen.

Dalea herbacea Sessé & Mociño ex G. Don, Gen. Hist. Dichl. Pl. **2**: 224. 1832 (*D. humilis*).

Dalea lateripes Mociño & Sessé ex DeCandolle, Prod. **2**: 245 (*D. citriodora*).

Dalea leptoclados Bentham ex Hemsley, Biol. Centr.-Amer., Bot. **1**: 242. 1880, nomen.

Dalea longipes Mociño & Sessé ex DeCandolle, Prod. **2**: 245. 1825 (*D. sericea*).

Dalea lutescens Cervantes ex G. Don, Gen. Hist. Dichl. Pl. **2**: 224. 1832 (*D. lanata*).

Dalea melilotoides Mociño & Sessé ex DeCandolle, Prod. **2**: 246. 1825 (*D. nutans*).

Dalea mota Gentry, Río Mayo Pl. 140. 1942 (*D. tomentosa*) — Cf. **D. tomentosa** var. **mota** Barneby.

Dalea onobrychioides Mociño & Sessé ex DeCandolle, Prod. **2**: 246. 1825 (*D. tomentosa*).

Dalea pendulina Mociño & Sessé ex DeCandolle, Prod. **2**: 245. 1825 (*D. tuberculata*).

Dalea seemanni var. *evillosa* Watson ex Rydberg, N. Amer. Fl. **24**: 88. 1920 (*Parosela tuberculata*).

Dalea spinescens Hemsley, Biol. Centr.-Amer. Bot. **1**: 247, lapsu pro *D. spinosa*.

Dalea unguicularis Mociño & Sessé ex DeCandolle, Prod. **2**: 245. 1825 (*D. mutabilis*).

Dalea velutipes Bentham ex Hemsley, Biol. Centr.-Amer., Bot. **1**: 241. 1880, nomen.

Dalea violacea Cervantes ex G. Don, Gen. Hist. Dichl. Pl. **2**: 225. 1832 (*D. pulcherrima*).

Parosela compactiflora Rose ex Rydberg, N. Amer. Fl. **24**: 91. 1920 (*P. tomentosa*).

Parosela rubricaulis Rose ex Rydb., N. Amer. Fl. **24**: 117. 1920 (*Thornbera lutea*).

Petalstemon luteolum Watson ex A. Heller, Bull. Torrey Club **23**: 122. 1896 (*Kuhnistera sabinalis*).

Petalostemon sessile Mociño & Sessé ex DeCandolle, Prod. *2*: 246. 1825 (*Dalea thouini*).

APPENDIX III: SPECIES EXCLUSAE

Dalea fruticosa G. Don, Gen. Hist. Dichl. Pl. **2**: 226. 1832. — "Native of Mexico... (v.s. herb. Lamb.)." — Holotypus, so labelled, OXF! = **Eysenhardtia polystachya** (Ortega) Sargent!

Dalea parviflora Pursh, Fl. Amer. Sept. **2**: 474. 1814. = **Astragalus gracilis** Nutt.; cf. Barneby, Mem. N. Y. Bot. Gard. **13**: 219. 1964.

Dalea tephrosioides Grisebach, Catal. Pl. Cuba 69. 1866. = **Indigofera sabulicola** Bentham; cf. Rydberg, N. Amer. Fl. **24**: 166. 1920.

Psoralea arborea Sessé & Mociño, Pl. Nov. Hisp. 121. 1889. — "Habitat in Oppido Apatzingam [Michoacán]." — The description suggests **Apoplanesia paniculata** Presl, common on dry hills around the town of Apatzingán (vidi!).

Psoralea fruticosa Sessé & Mociño, Pl. Nov. Hisp. 121. 1889. — "Habitat...cum praecedente" i. e. "in Oppido Apatzingam." — Probably equivalent to *Dalea fruticosa* G. Don, listed above, and therefore = **Eysenhardtia polystachya** (Ort.) Sarg.

Psoralea stipularis Sessé & Mociño, Fl. Mex. ed 2, 169. 1894. — If of tribe Amorpheae, can only be *Eysenhardtia*, but probably of another tribe.

APPENDIX IV. VOUCHERS FOR CHROMOSOME COUNTS

Herein are listed vouchers for hitherto unpublished chromosome counts recorded above in the descriptive text. It is an agreeable duty to acknowledge the generosity of Dr. Theodore Mosquin and Dr. Richard Spellenburg for these invaluable contributions to the cytology of tribe *Amorpheae*. The material in this Appendix should be regarded as independent publications of these authors.

1. Counts contributed by Theodore Mosquin (formerly of Vascular Plant Herbarium, Department of Agriculture, Central Experiment Farm, Ottawa, Canada).

Vouchers are deposited at DAO or NY, or at both.

Dalea aurea Nutt. 2n = 7_{II} (*Mosquin 5703*); 2n = 14 (*Ripley & Barneby 14785*).

D. bicolor Humb. & Bonpl. var. *bicolor*. 2n = 7_{II} (*Mosquin 6887*) 2n = 28 (*Mosquin 6855, 6858*).

D. bicolor var. *naviculifolia* (Hemsl.) Barneby. 2n = 14 (*Ripley & Barneby 14666*).

D. brachystachya Gray. 2n = 7_{II} (*Mosquin 8696*); 2n = 14 (*Mosquin 6662, 6904*).

D. caeciliae Harms. 2n = 14 (*Ripley & Barneby 14687*).

D. carthagenensis (Jacqu.) Macbr. var. *capitulata* (Rydb.) Barneby. 2n = 14 (*Ripley & Barneby 14722*).

D. cliffortiana Willd. 2n = 14 (*Ripley & Barneby 14108*).

D. cyanea Greene. 2n = 7_{II} (*Mosquin 6878*).

D. enneandra Nutt. 2n = 14 (*Barneby 13808*).

D. erythrorrhiza Greenm. 2n = 14 (*Ripley & Barneby 14144, 14164*).

D. exserta (Rydb.) Gentry 2n = 14 (*Ripley & Barneby 14564*).

D. filiciformis Robins. & Greenm. 2n = ± 8_{II} (*Mosquin 6663*).

D. filiformis Gray. 2n = 14 (*Ripley & Barneby 13878*).

D. foliolosa (Ait.) Bullock var. *citrina* (Rydb.) Barneby. 2n = 14 (*Ripley & Barneby 14051, 14566*).

D. grayi (Vail) L. O. Williams. 2n = 14 (*Mosquin 6889*).

D. greggii Gray. 2n = 7_{II} (*Mosquin 6677*).

D. gypsophila Barneby. 2n = 14 (*Ripley & Barneby 14775*).

D. hegewischiana Steud. 2n = 14 (*Ripley & Barneby 14626, 14658*).

D. insignis Hemsl. 2n = 14 (*Ripley & Barneby 14671*).

D. lachnostachya Gray. 2n = 7_{II} (*Mosquin 6568, 6918*).

D. lanata Spreng. var. *lanata*. 2n = 14 (*Mosquin 6938*).

D. lanata var. *terminalis* (M. E. Jones) Barneby. 2n = 14 (*Barneby 13849*).

D. laniceps Barneby. 2n = 14 (*Ripley & Barneby 13928*).

D. leporina (Ait.) Bullock. 2n = 7_{II} (*Mosquin 6769*); 2n = 14 (*Mosquin 6653; Ripley & Barneby 14189, 14518*).

D. leucosericea (Rydb.) Standl. & Steyerm. 2n = 14 (*Ripley & Barneby 14616*).

D. leucostachya Gray var. *leucostachya*. 2n = 7_{II} (*Mosquin 6888*).

D. luisana Wats. 2n = 14 (*Ripley & Barneby 14715*).

D. melantha Schau. var. *melantha*. 2n = 7_{II} (*Mosquin 6676*); 2n = 14 (*Ripley & Barneby 14710*).

D. mixteca Barneby. 2n = 14 (*Ripley & Barneby 14688*).
D. mollis Benth. 2n = 16 (*E. K. Balls 12961*).
D. mollissima (Rydb.) Munz. 2n = 16 (*Thorne & Rutherford 33579; Barkley & Reed 4236; Twisselmann 11948*).
D. mucronata DC. 2n = 14 (*Ripley & Barneby 14516*).
D. nana Torr. var. *nana*. 2n = 7_{II} (*Mosquin 5498, 5665*).
D. nana var. *carnescens* (Rydb.) Kearn. & Peeb. 2n = 14 (*Mosquin 5677, 6564; Ripley & Barneby 14484*).
D. nelsoni (Rydb.) Barneby. 2n = 7_{II} (*Mosquin 6828; Ripley & Barneby 14961*).
D. neo-mexicana (Gray) Cory var. *neo-mexicana*. 2n = 16 (*Mosquin 6569*).
D. neo-mexicana var. *megaladenia* Barneby. 2n = 16 (*Ripley & Barneby 14207*).
D. obovatifolia Ort. var. *obovatifolia*. 2n = 7_{II} (*Mosquin 6657*); 2n = 14 (*Mosquin 6672; Ripley & Barneby 14523*).
D. obreniformis (Rydb.) Barneby. 2n = 28 (*Ripley & Barneby 14535, 14835*).
D. pectinata Kunth. 2n = 7_{II} (*Mosquin 6833*); 2n = 14 (*Ripley & Barneby 14134*).
D. pogonathera Gray var. *pogonathera*. 2n = 7_{II} (*Mosquin 6901*); 2n = 14 (*Mosquin 5694, 6570*).
D. pogonathera var. *walkerae* (Tharp & Barkl.) B. L. Turner. 2n = 14 (*Barneby 14485*).
D. polygonoides Gray. 2n = 7_{II} (*Mosquin 6829*).
D. prostrata Lag. 2n = 14 (*Ripley & Barneby s. n.*, e Querétaro).
D. reclinata (Cav.) Willd. 2n = 14 (*Ripley & Barneby 13964, 14521*).
D. scandens (Mill.) Claus. var. *paucifolia* (Coult.) Barneby. 2n = 14 (*Ripley & Barneby 14752*).
D. sericea Lag. var. *sericea*. 2n = 7_{II} (*Mosquin 6766, 6834*); 2n = 14 (*Ripley & Barneby 14126, 14624, 14795*).
D. simulatrix Barneby. 2n = 16 (*Mosquin 6920*).
D. thouini Schrank. 2n = 14 (*Ripley & Barneby 14169, 14526*).
D. versicolor Zucc. var. *versicolor*. 2n = 14 (*Ripley & Barneby 14689*).
D. versicolor var. *glabrescens* (Rydb.) Barneby. 2n = 28 (*Mosquin 6835*).
D. versicolor var. *involuta* (Rydb.) Barneby. 2n = 14 (*Mosquin 6737*).
D. versicolor var. *glabrescens* (Rydb.) Barneby. 2n = 28 (*Mosquin 6835*).
D. wrightii Gray. 2n = 14 (*Mosquin 5641; Ripley & Barneby 14509*).
Marina gracilis Liebm. 2n = 20 (*Ripley & Barneby 14694*).
M. greenmaniana (Rose) Barneby. 2n = 20 (*Ripley & Barneby 14581, 14672*).
M. neglecta B. L. Robins. var. *neglecta*. 2n = 10_{II} (*Mosquin 6669, 6782, 6786*); 2n = 20 (*Ripley & Barneby 14131. 14578*).
M. nutans (Cav.) Barneby. 2n = 20 (*Ripley & Barneby 14664, 14758*).
M. procumbens (S. & M.) Barneby. 2n = 20 (*Ripley & Barneby 14693*).
M. pueblensis (Brandg.) Barneby. 2n = 20 (*Ripley & Barneby 14575, 14576*).
M. spiciformis (Rose) Barneby. 2n = 20 (*Ripley & Barneby 14735, 14746*).
Psorothamnus kingii (Wats.) Barneby. 2n = 20 (*Holmgren & Reveal 2877*).

2. Counts contributed by Richard Spellenberg (New Mexico State University, Las Cruces). Vouchers are deposited at NMC, NY, or at both.

Dalea leucostachya Gray var. *eysenhardtioides* (Hemsl.) Barneby. n = 7 (*Spellenberg & Dunford 2962*).
D. neo-mexicana (Gray) Cory var. *neo-mexicana*. n = 8 (*Spellenberg & Syvertsen 3746*).
D. wrightii Gray. n = 7 (*Spellenberg & Syvertsen 3752A*).
Marina diffusa (Moric.) Barneby var. *diffusa*. n = 10 (*Spellenberg & Dunford 2950*). Mistakenly reported as n = 7 in Taxon **22**: 654.
Psorothamnus fremontii (Torr.) Barneby var. *fremontii*. 2n = ± 20 (*Spellenberg, Delson & Syvertson 3133*).

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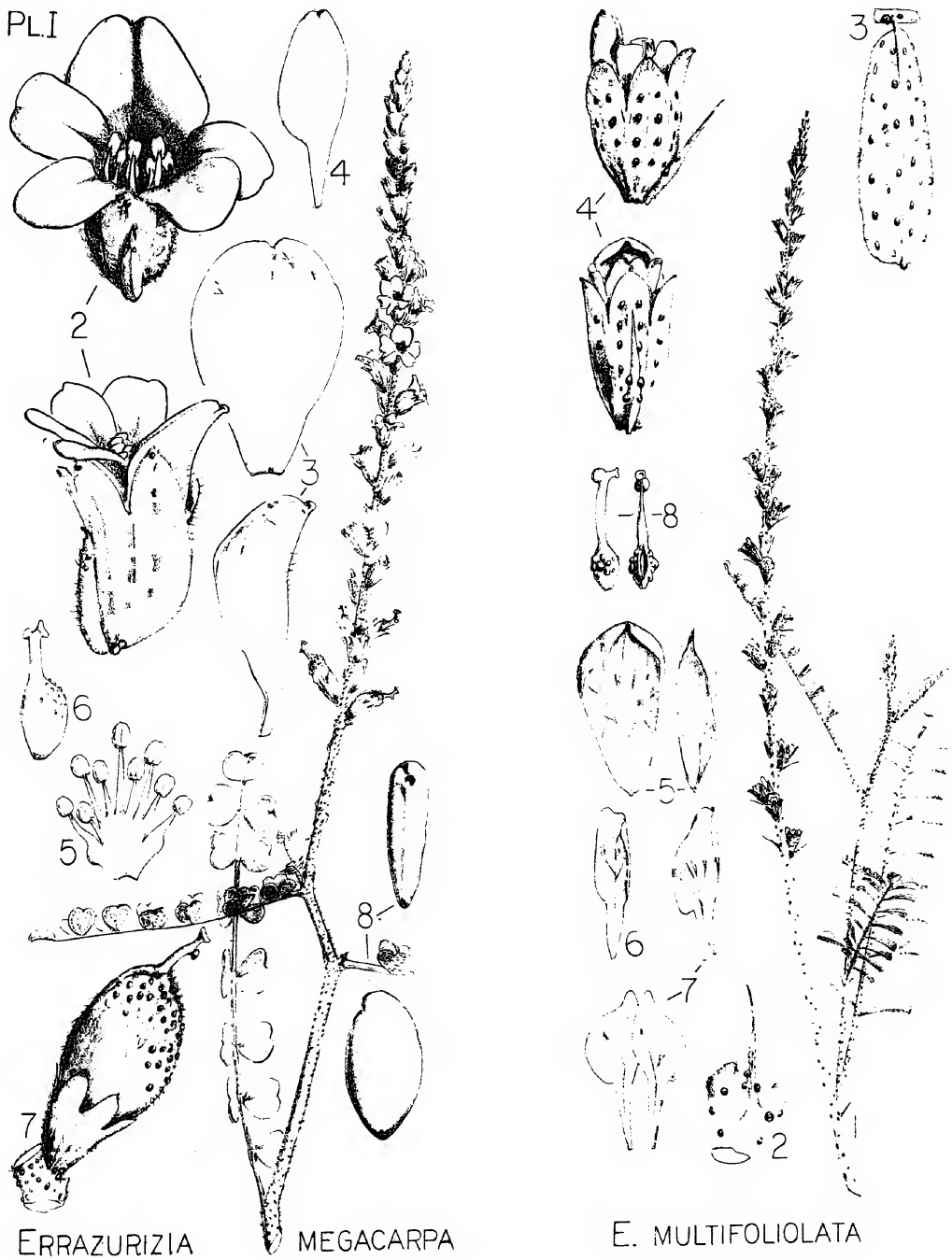
PLATES

PLATE I

Errazurizia megacarpa (Wats.) Jtn. and **E. multifoliolata** (Clos) Jtn., soft shrubs of maritime desert climate on the Pacific coast of North and South America, the former dispersed around the Gulf of California in Sonora and Baja California, the latter endemic to Chile's nitrate coast. Both have gray-pubescent foliage, heavily glandular and pungently aromatic when crushed, pale yellow petals, and a globose gland situated on the style just below the stigma. — Stems with inflorescence × 1; the rest × 5.

E. megacarpa: 1) leaves and spike; 2) flowers, ventral and profile views; 3) banner, ventral and profile views; 4) keel-petal; 5) androecium laid out; 6) ovary; 7) pod; 8) seed, ventral and profile views.

E. multifoliolata: 1) leaves and spike; 2) stipule; 3) leaflet, dorsal view; 4) flower, profile and ventral views; 5) banner, ventral and half-profile views; 6) wing; 7) keel-petals, profile and laid out; 8) ovary.


PL.I
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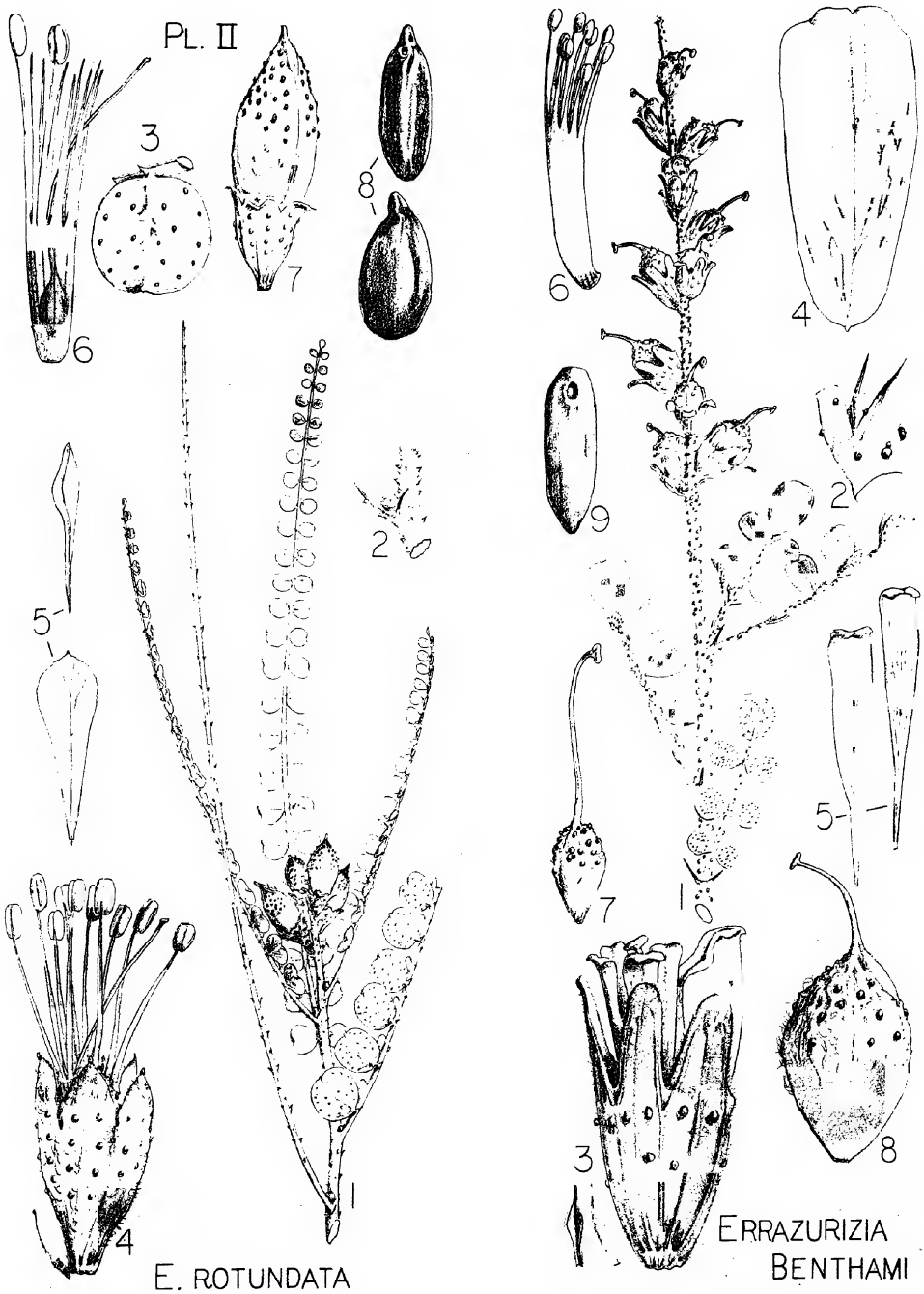
ERRAZURIZIA MEGACARPA
E. MULTIFOLIOLATA

PLATE II

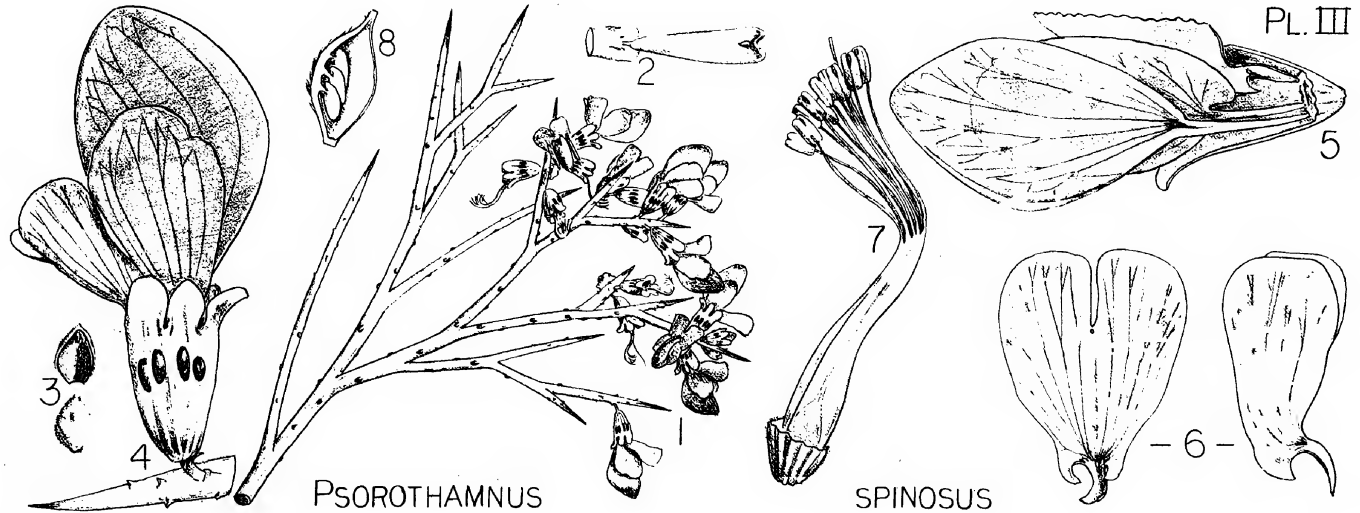
Errazurizia benthami (Brandg.) Jtn. and **E. rotundata** (Woot.) Barneby, dwarf gnarled shrubs with aromatically glandular, ashen-hairy foliage and relatively few-flowered spikes of sessile calyces. The pale yellow flower of *E. benthami* is essentially like that of related species shown in Plate I, but the plant differs in its indurated-spinose stipules, few leaflets, and capitate stigma surmounting a glandless style. The range of *E. benthami* lies along the Pacific shore of Baja California and adjoining islands, where it flowers at irregular intervals following rains. The flower of *E. rotundata* is either apetalous or rarely contains hidden within the calyx-tube a vestigial, dorsally pubescent banner, but in place of a showy perianth has a conspicuously exserted tassel of stamens. The very numerous small round leaflets diminishing upward along the stiff leaf-rachis and the habitat on red sandstone of the Colorado canyonlands in northern Arizona set *E. rotundata* apart from all Amorpheae. — Branches with fruits × 1; the rest × 5.

E. benthami: 1) fruiting branchlet; 2) stipules; 3) flower + bracts; 4) banner, ventral view; 5) inner petals; 6) androecium; 7) ovary; 8) pod; 9) seed, ventral view.

E. rotundata: 1) fruiting branch; 2) stipules; 3) leaflet, dorsal view; 4) flower + bract; 5) banner, half-profile and ventral views; 6) androecium; 7) pod; 8) seed, ventral and lateral views.


PL. II
E. ROTUNDATA
ERRAZURIZIA
BENTHAMI

PL. III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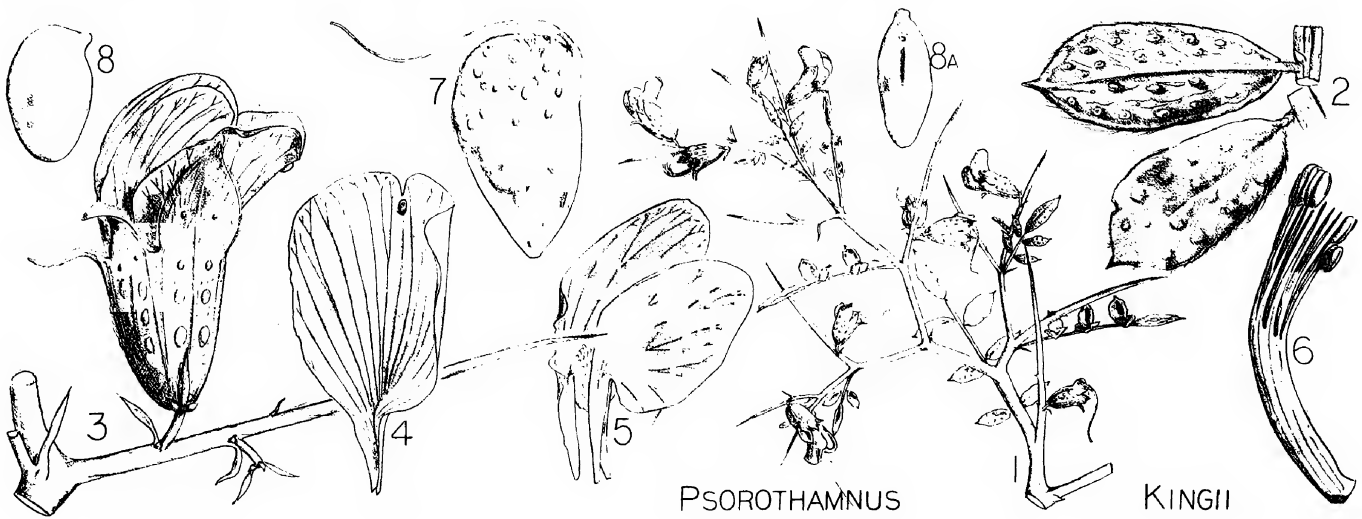
PSOROTHAMNUS SPINOSUS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PSOROTHAMNUS KINGII

PLATE III

Psorothamnus spinosus (Gray) Barneby and **Ps. kingii** (Wats.) Barneby, taxonomically isolated species of western North American deserts, the former, the Smoke Tree, widespread over the Sonoran Desert from the s. margins of the Mohave to n.-w. Sonora and centr. Baja California, the latter local on dunes in the lower Humboldt River valley in n. Nevada. In both species the flowers are borne laterally to a thorn-tipped rachis, but in other respects they are wholly different. The Smoke Tree is a small tree at maturity, leafless or nearly so, with innumerable silvery-gray branchlets clothed in summer with vivid indigo flowers. Of all Amorpheae, *Ps. spinosus* is the only species with more than two ovules; note also the callosities at base of the banner-blade. By contrast *Ps. kingii* is a lowly herb with diffuse, zigzag stems arising singly from wide-creeping rhizomes. The developed leaflets are sharply mucronate, the raceme is reduced to 1–4 flowers, the petals are clear blue, opening June to August. — Flowering branchlets or stems × 1; the rest × 5.

Ps. spinosus: 1) summit branchlets; 2) leaf; 3) bract, ventral and dorsal views; 4) flower; 5) flower with calyx cut away to show insertion of petals; 6) banner, ventral and profile views; 7) androecium; 8) ovary, dissected lengthwise.

Ps. kingii: 1) flowering stem; 2) leaflets; 3) raceme + flower; 4) banner, ventral view; 5) wing (back) and keel-petal; 6) androecium; 7) pod (2-seeded); 8, 8a) seeds, profile and ventral views.

PLATE IV

Psorothamnus schottii (Torr.) Barneby, **Ps. fremontii** (Torr.) Barneby with leaves of var. **attenuatus** Barneby, and **Ps. arborescens** (Torr.) Barneby with vars. **arborescens**, **simplifolius** (Parish) Barneby, **pubescens** (Parish) Barneby, and **minutifolius** (Parish) Barneby comprise the sect. *Xylodalea*, a group of closely inter-related thorny shrubs with showy indigo-blue or vivid purple flowers giving rise to large exserted pods enclosing a massive seed. Collectively they are dispersed over the whole Mohave and Colorado deserts in California and adjoining Nevada and Arizona, *Ps. schottii* extending south into Baja California and the other two northeast into the canyonlands of southern Utah and northern Arizona. Notable features of the group are instability of vesture and polymorphism of the foliage, the leaflets varying from green and glabrate to gray-tomentulose or silvery and from short-petiolulate to sessile and confluent. Note the short-toothed calyx combined with simple or partly trefoil leaves of *Ps. schottii*; the densely glandular pod of *Ps. fremontii*; and the different leaf-types of *Ps. arborescens* sens. lat. Flowering branchlets and detached leaves × 1; the rest × 2.

Ps. schottii: 1) flowering branchlet; 2) a trifoliolate leaf; 3) flower; 4) calyx (pubescent variant); 5) pod.

Ps. fremontii var *fremontii*: 1) flowering branchlet; 2) calyces; 3) leaves; 4) banner (ventral view); 5) wing; 6) keel; 7) pod; var. *attenuatus*: 8) leaves.

Ps. arborescens var. *arborescens*: 1) calyces, pubescent and glabrate; 2) leaves; var. *simplifolius*: 3) flowering branchlet; 4) sterile branchlet with reduced foliage; 5) flower + bract; 6) banner (ventral view); 7) pod; var. *pubescens*: 8) leaf, calyces, and pod; var. *minutifolius*: 9) flowering branchlet; 10) leaflets; 11) flower; 12) banner (profile view); 13) keel; 14) androecium.

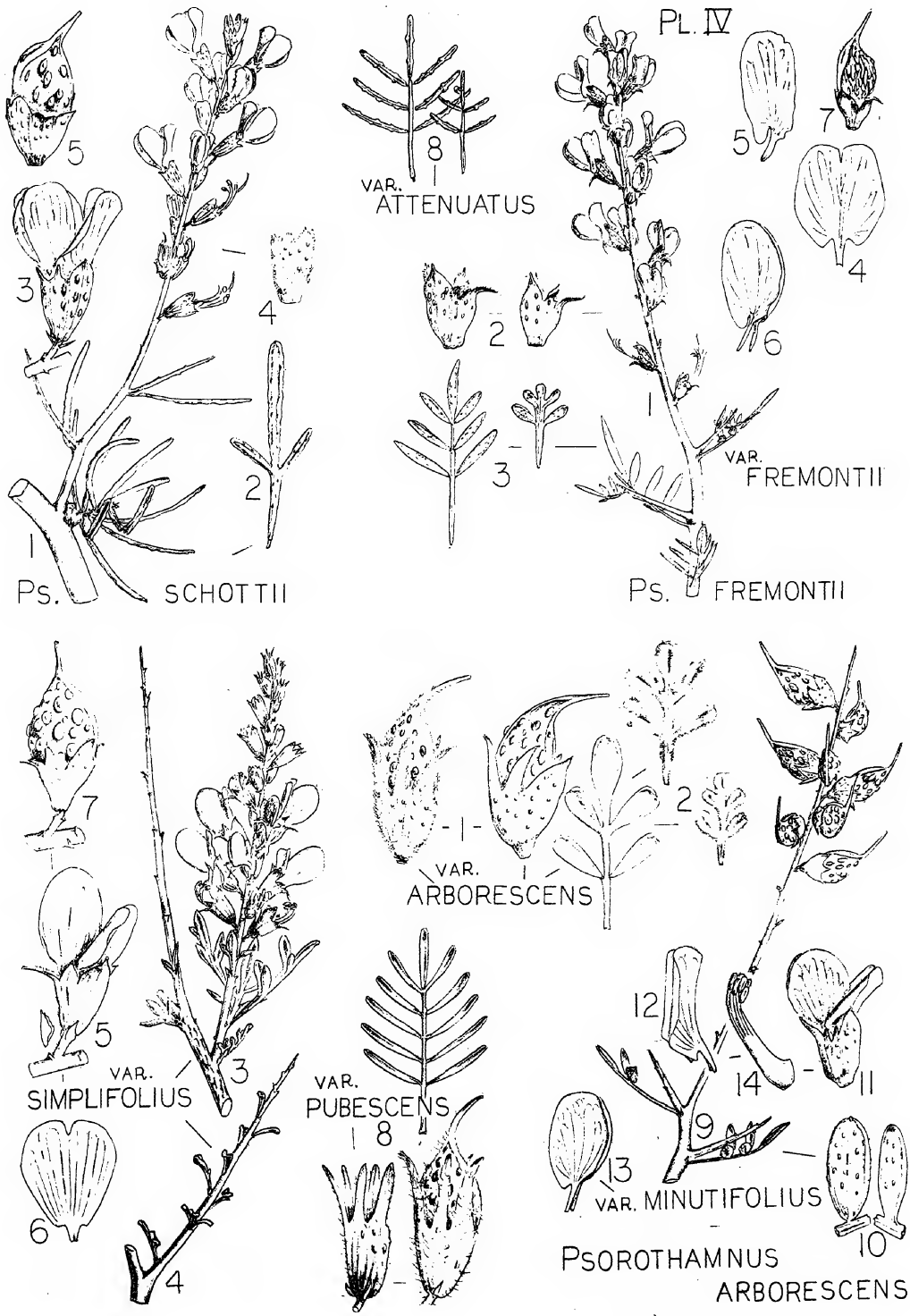
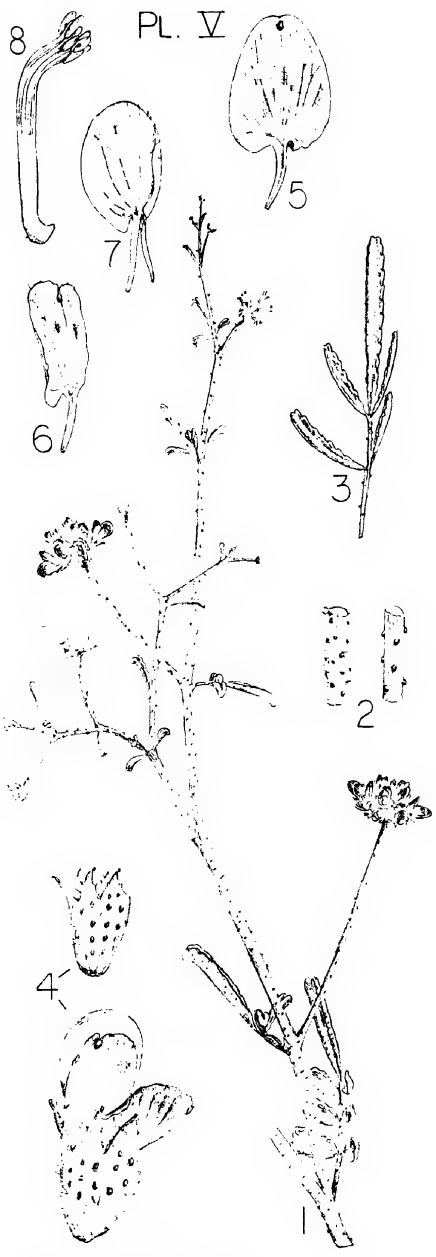

PL. IV
VAR. ATTENUATUS
VAR. FREMONTII
Ps. SCHOTTII
Ps. FREMONTII
VAR. ARBORESCENS
VAR. SIMPLIFOLIUS
VAR. PUBESCENS
VAR. MINUTIFOLIUS
PSOROTHAMNUS ARBORESCENS

PLATE V

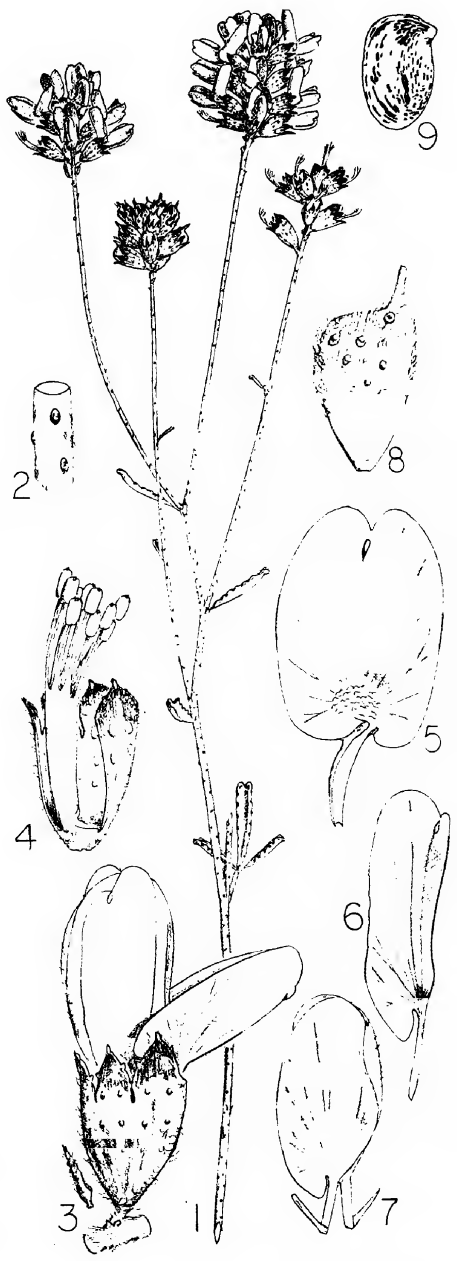
Psorothamnus emoryi var. **arenarius** (Brandg.) Barneby and **Ps. scoparius** (Gray) Rydb., softly shrubby plants of dunes and sandy or gravelly desert hills, the former endemic to central and southern Baja California, the latter to the Chihuahuan Desert, with extension northward up Rio Grande into north-central New Mexico and west across the Divide into northeastern Arizona. The var. *arenarius*, which may flower precociously as a diffuse herb, becomes a low bushy plant wider than tall; it is usually gray-tomentulose throughout but the stems are rarely green and hairless. The entire plant is charged with fragile orange glands that yield when bruised a turpentine-scented oil; the little-exserted petals are tipped with violet and thinly villosulous externally. Note the pleomorphic foliage, the pinnate lower leaves passing upward along the stems into a simple, subsessile blade. Compare also with var. *emoryi* (Pl. VI). The adult plant of *Ps. scoparius* forms a round-topped bush of innumerable, pliant, broomlike stems, gray-silky with retrorse hairs and gland-speckled like those of *Ps. emoryi*, but with less fragile glands. Here all leaves are unifoliolate, or a few trifoliolate, but none are pinnate; of whatever type they fall off early, seldom persisting until the seeds are ripe. The petals of *Ps. scoparius* are vivid blue, sometimes blue-purple, exceptionally white. Flowering branchlets and detached leaf of var. *arenarius* × 1; the rest × 5.

Ps. emoryi var. *arenarius*: 1) flowering branchlet; 2) pieces of upper stems, of the tomentulose and glabrous variants; 3) stem-leaf of glabrous variant; 4) flower + calyx; 5) banner (ventral view); 6) wing; 7) keel; 8) androecium.

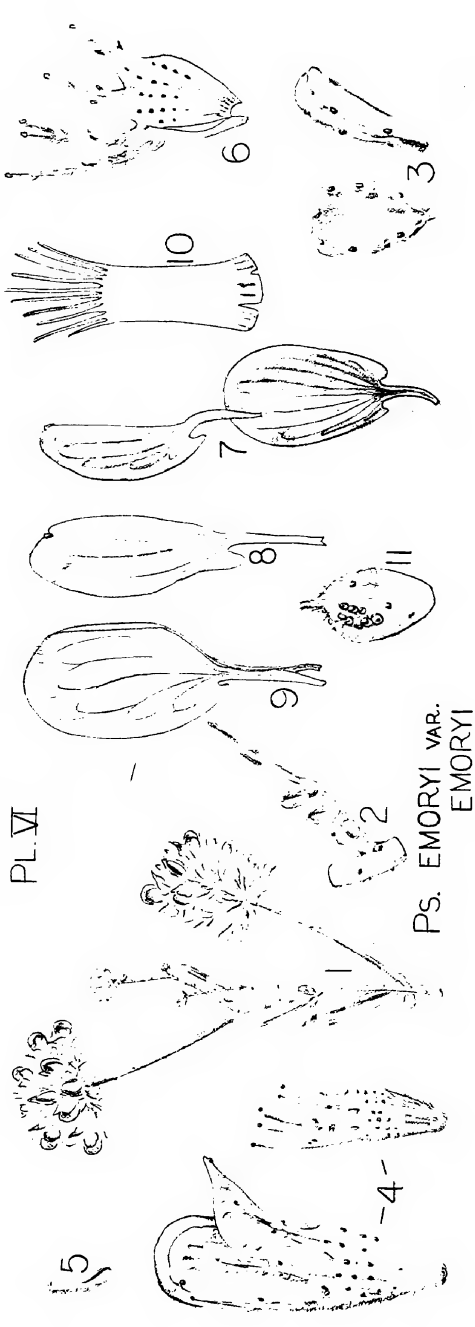
Ps. scoparius: 1) flowering branchlet; 2) piece of stem; 3) flower + bract; 4) calyx, opened to show androecium; 5) banner (ventral view); 6) wing; 7) keel; 8) pod; 9) seed.



PSOROTHAMNUS
EMORYI VAR. ARENARIUS



PS. SCOPARIUS


PL. VI
PS. EMORYI VAR. EMORYI

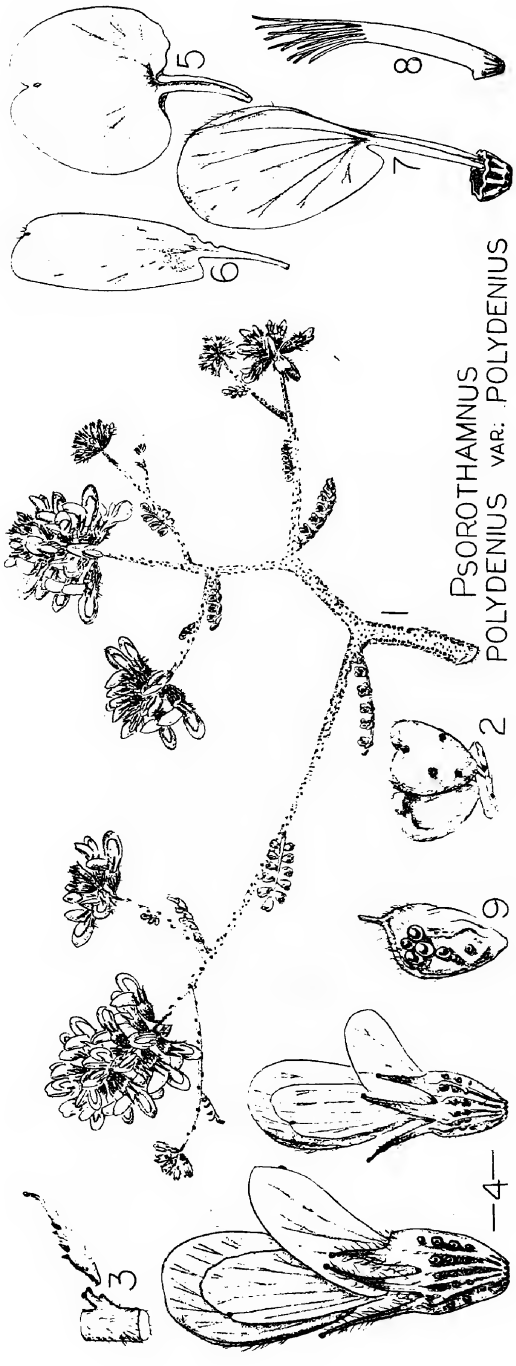

PSOROTHAMNUS POLYDENIUS VAR. POLYDENIUS

PLATE VI

Psorothamnus emoryi (Gray) Rydb. var. **emoryi** and **Ps. polydenius** (Torr.) Rydb. var. **polydenius**, softly woody desert shrubs with gray or white-woolly foliage and small, pink-purple flowers with dorsally pubescent keel. The stems and few leaflets of *Ps. emoryi* are tomentulose with antrorsely spreading hairs and its range, including that of var. *arenarius* (Brandg.) Barneby (Plate V), extends over the Sonoran Desert, from Coachella Valley in s.-e. California s. into Baja California. Its near relationship is with the junceous *Ps. scoparius* (Plate V). The stem-pubescence of *Ps. polydenius* is directed downward, the hairs interspersed with very numerous small red blister-glands, and the range including that of its var. *jonesii* (Plate VII) covers the colder and higher deserts of Nevada and Utah, extending west locally to the south Mohave Desert in California. The relatively widespread var. *polydenius* extends w. from extreme s.-w. Utah and n. into the Lahontan Basin in Nevada; its calyx varies from villous all over to glabrous except for hairy teeth. The poorly differentiated var. *jonesii*, differing in its caudately elongate bracts and calyx-teeth and less congested flowers and leaflets, is known only from the banks of Green River in e.-centr. Utah. — Flowering branchlets × 1; the rest × 5.

Ps. emoryi var. *emoryi*: 1) branchlet; 2) primary cauline leaf, with 3 pairs of small lateral leaflets; 3) leaflets of broad type; 4) flower and calyx, showing some of the known variation in size; 5) bract; 6) calyx, laid open, to show the small orange-red glands on the yellow tube; 7) banner, profile and ventral views; 8) wing; 9) keel; 10) androecium, laid open; 11) pod.

Ps. polydenius var. *polydenius*: 1) branchlet; 2) leaflets; 3) pedicel and deciduous bract; 4) flowers, showing variation in size and pubescence of calyx (left, so-called var. *subnuda*); 5) banner, ventral view; 6) wing; 7) keel, attached to hypanthium rim; 8) androecium; 9) pod.

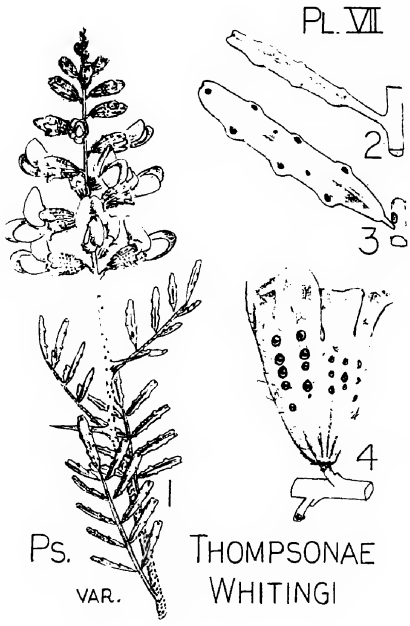
PLATE VII

Psorothamnus thompsonae (Vail) Welsh & Atwood and **Ps. polydenius** var. **jonesii** Barneby (for caption see Plate VI). The prickly shrubs of *Ps. thompsonae* reach a height of a meter or more and often are as wide as tall, garnished in June with multitudinous racemes of vivid rose-purple flowers. The species occurs locally on dunes and talus derived from sandstones in the canyonlands of the Colorado Plateau, the var. **thompsonae**, with obovate leaflets, endemic to s.-e. Utah, the var. **whitingi** (Kearn. & Peeb.) Barneby, with linear-oblanceolate leaflets, vicariant s.-ward into n. Arizona. Remarkable features of *Ps. thompsonae* are the retrorse pubescence of the stems, which are closely dotted with red blister-glands, and marcescent petals. —Flowering branchlets × 1; the rest × 5.

var. *thompsonae*: 1) branch at anthesis; 2) segment of stem, showing retrorse hairs and prominent glands; 3) leaflets; 4) calyx; 5) banner, ventral view; 6) keel-petals, permanently attached to hypanthium rim; 7) androecium; 8) pod.

var. *whitingi*: 1) flowering branchlet; 2) decurrent leaflet; 3) petiolulate leaflet; 4) calyx.

D. polydenius var. *jonesii*: 1) flowering branchlet; 2) flower + bract; 3) banner, profile view.


PL. VII
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Ps. THOMPSONAE VAR. WHITINGI

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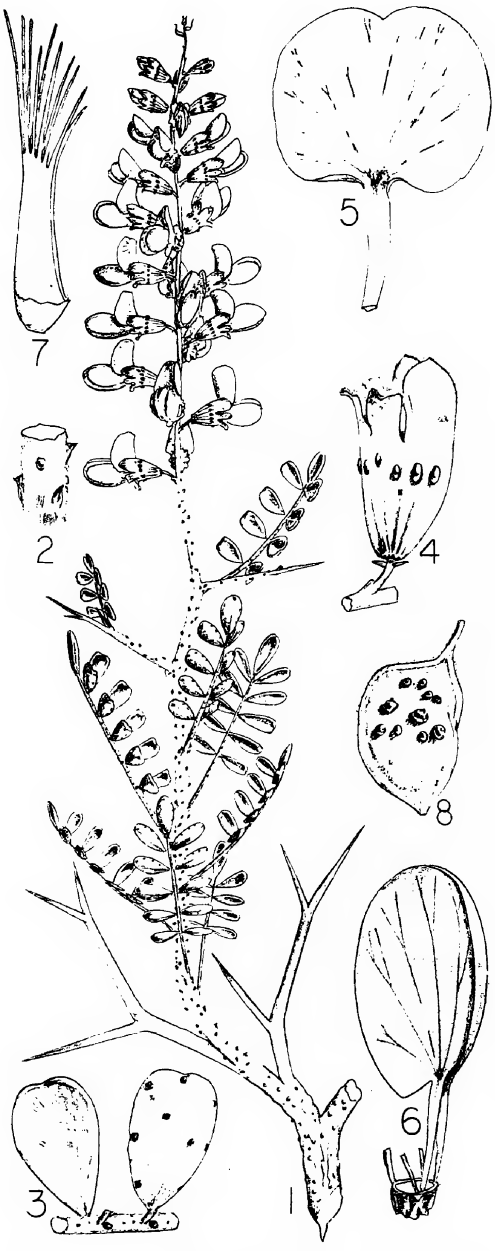
Ps. POLYDENIUS VAR. JONESII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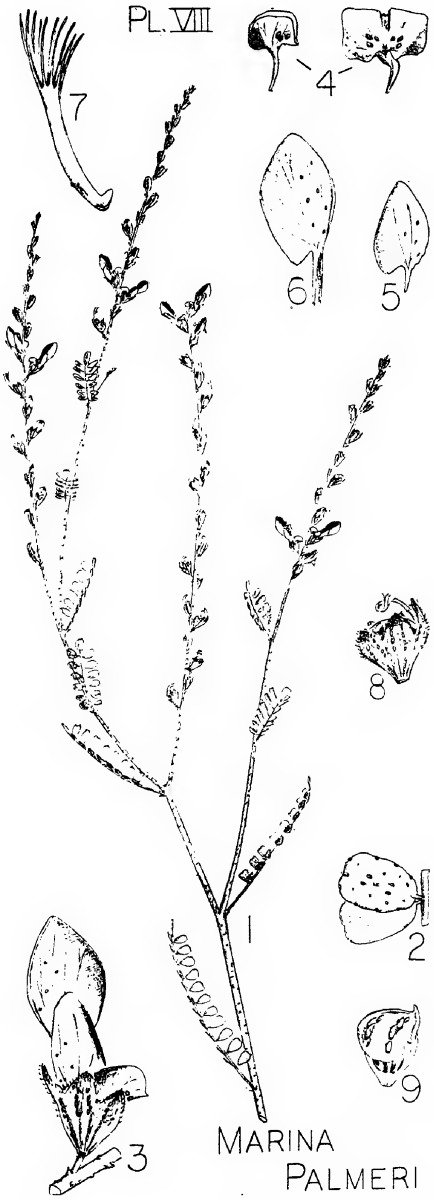
PSOROTHAMNUS THOMPSONAE VAR. THOMPSONAE

PLATE VIII

Marina palmeri (Rose) Barneby and **M. parryi** (T. & G.) Barneby, herbaceous or ultimately suffruticose plants reaching a height of one meter but mostly much smaller, with warty stems often glaucescent in age, thick-textured, green or gray-strigulose foliage, and gland-sprinkled petals. The flowers of both are commonly bicolored, with a purple stripe down the inner half of all the petals, but in *M. parryi* sometimes all blue. The range of the very variable *M. parryi* is almost coextensive with the boundaries of the Sonoran Desert; it extends from the Colorado and southeastern Mohave deserts in California and the Gila Basin in Arizona s. through Sonora to the neighborhood of Guaymas, and through Baja California to La Paz. The closely related but more glabrous and smaller-flowered *M. palmeri* follows the Sierra Madre piedmont from the Río Mayo in s. Sonora to near Mazatlán in Sinaloa (± 23° 50′–27° S.), where it is an inhabitant of the drought-deciduous thorn-scrub and Short-tree Forest. Both species are adapted to withstand long periods of drought and flower irregularly following rains. — Habit × 1; the rest × 5.

M. palmeri: 1) flowering branchlet; 2) leaflets; 3) flower; 4) banner, profile and ventral views; 5) wing; 6) keel; 7) androecium; 8) fruiting calyx; 9) pod.

M. parryi: 1) raceme + leaf (the peduncle longer than usual); 2) leaflets; 3) flower; 4) banner, profile and ventral views; 5) wing; 6) keel; 7) androecium; 8) fruiting calyx; 9) pod.


PL. VIII
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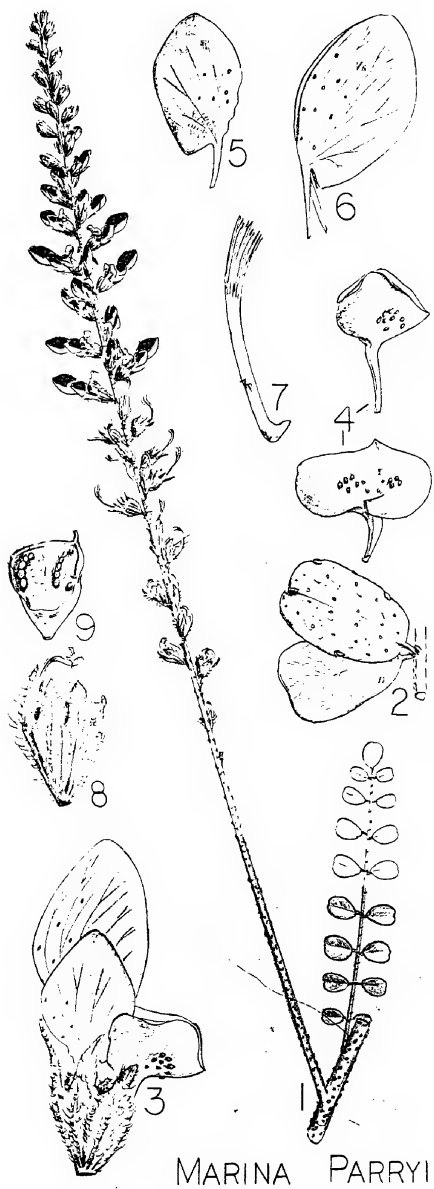
MARINA
PALMERI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MARINA PARRYI

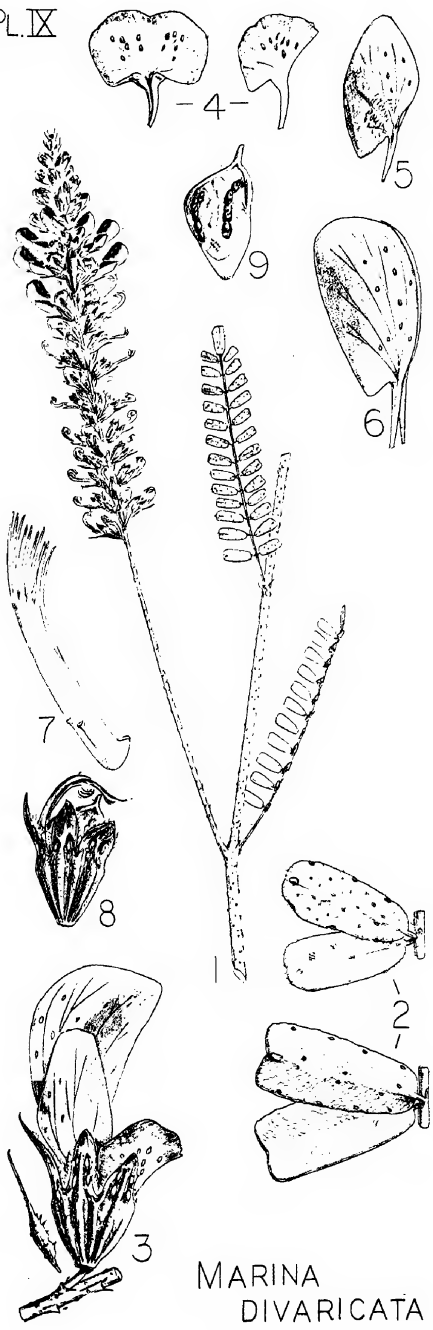
PLATE IX

Marina maritima (Brandg.) Barneby and **M. divaricata** (Benth.) Barneby, both endemic to the s. half of Baja California Sur, are closely related both to each other and to *M. parryi* (Plate VIII), from which they differ collectively in the firm calyx-tube charged only beyond the middle of each interval with 1–3 (not a chain of small) blister-glands. Both have warty stems and bicolored flowers, the banner purple-edged or purple-eared, contrasting with a gland-sprinkled yellowish eye, and the wings and keel vertically purple-stiped along the inner edge. The relatively glabrous, precociously flowering but ultimately stiffly bushy *M. divaricata* has glaucescent older stems, green leaflets either hairless or thinly pilosulous, and a calyx glabrous and shining externally although ciliolate at the mouth. Its range extends on stony and sandy desert shores from Magdalena Bay (at ± 25° N) along the Atlantic coast to Cabo San Lucas and San José, and climbs inland on the Cape mountains into the oak-belt. The more densely pubescent *M. maritima* has gray or silvery-white stems and a calyx loosely hairy outside upward from the base or middle of the tube. It is a dune plant, confined to the shore or to sandy washes opening into the Gulf, and is locally plentiful in the vicinity of La Paz, with one outlying station on the Pacific coast shortly above the Cape. — Inflorescences × 1; the rest × 5.

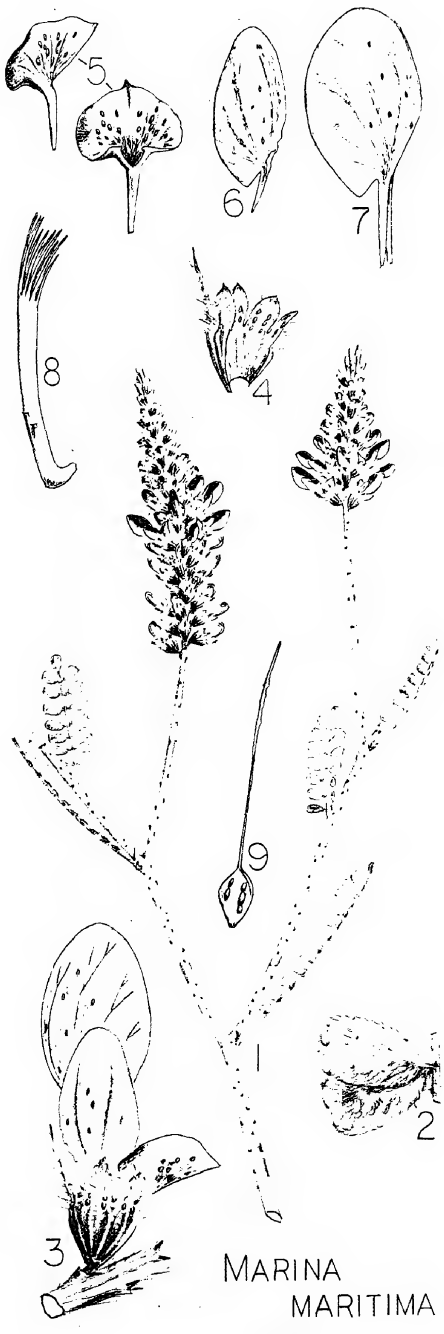
M. maritima: 1) part of stem 2) leaflets; 3) flower; 4) calyx, laid open; 5) banner, profile and ventral views; 6) wing; 7) keel; 8) androecium; 9) ovary + style.

M. divaricata: 1) part of stem; 2) leaflet of two types; 3) flower + bract; 4) banner, ventral and profile views; 5) wing; 6) keel; 7) androecium; 8) fruiting calyx; 9) pod.

PL. IX



MARINA
DIVARICATA



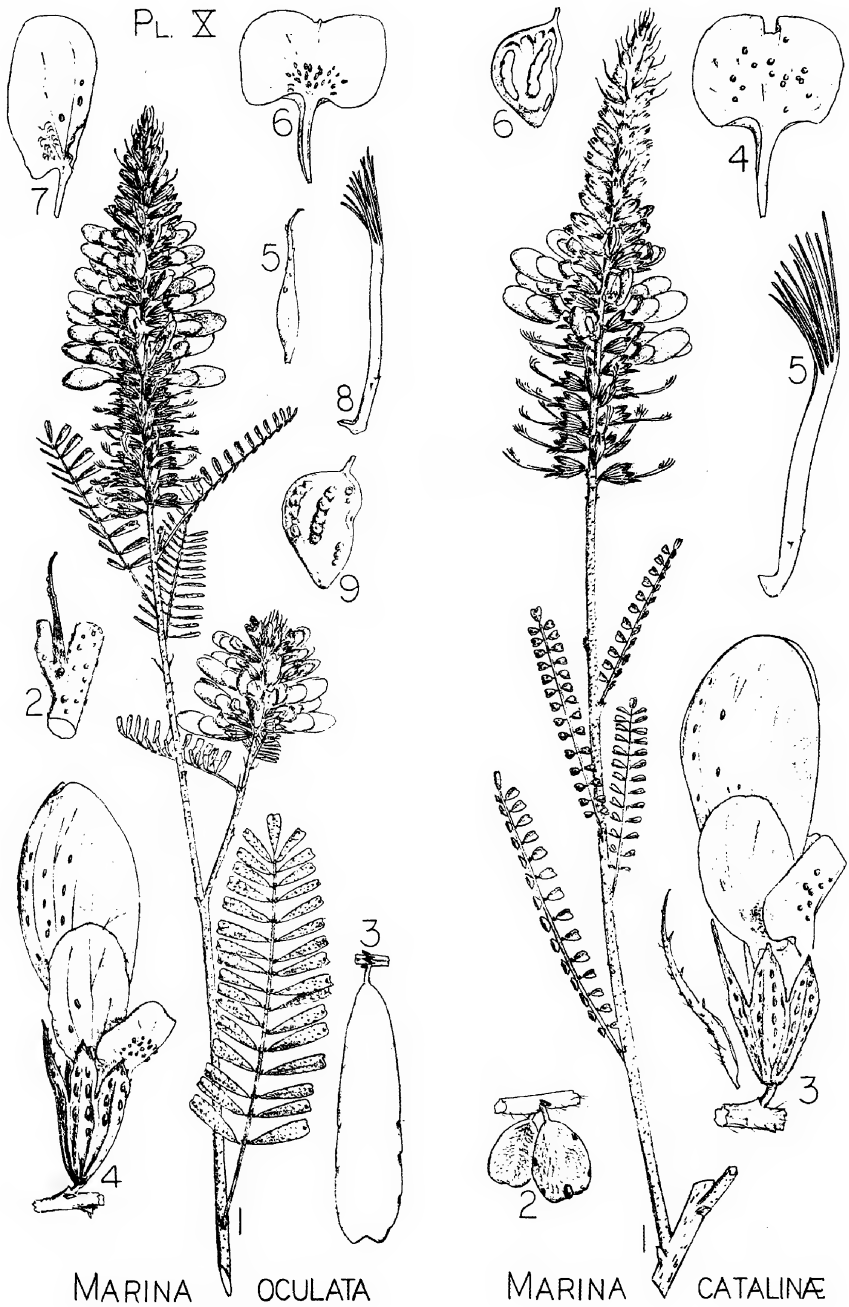
MARINA
MARITIMA

PLATE X

Marina oculata (Rydb.) Barneby and **M. catalinae** Barneby are insular derivatives of the variable peninsular *M. divaricata* (Bth.) Barneby, suffruticose or definitely shrubby species each known from only one island off the east coast of Baja California, *M. oculata* from Isla Cerralvo, at lat. ± 24° 15′ N, *M. catalinae* from Isla Catalina, at ± 25° 40′ N. They are distinguished collectively by the combination of many leaflets (often 12 or more pairs) with long narrow bracts and large vivid blue flowers. The young branchlets of *M. oculata* are white-strigulose, the leaflets of thin texture, and the calyx glabrous below the ciliolate mouth. In *M. catalinae* the branchlets are glabrous, the small leaflets fleshy-thickened, and the calyx pilosulous externally from the base upward. Inflorescences × 1; the rest × 5.

M. oculata: 1) flowering branch; 2) stipules; 3) leaflet, upper face; 4) flower; 5) bract; 6) banner, ventral view; 7) wing; 8) androecium; 9) pod.

M. catalinae: 1) flowering branch; 2) leaflets; 3) flower + bract; 4) banner, ventral view; 5) androecium; 6) young pod.


PL. X
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MARINA OCULATA
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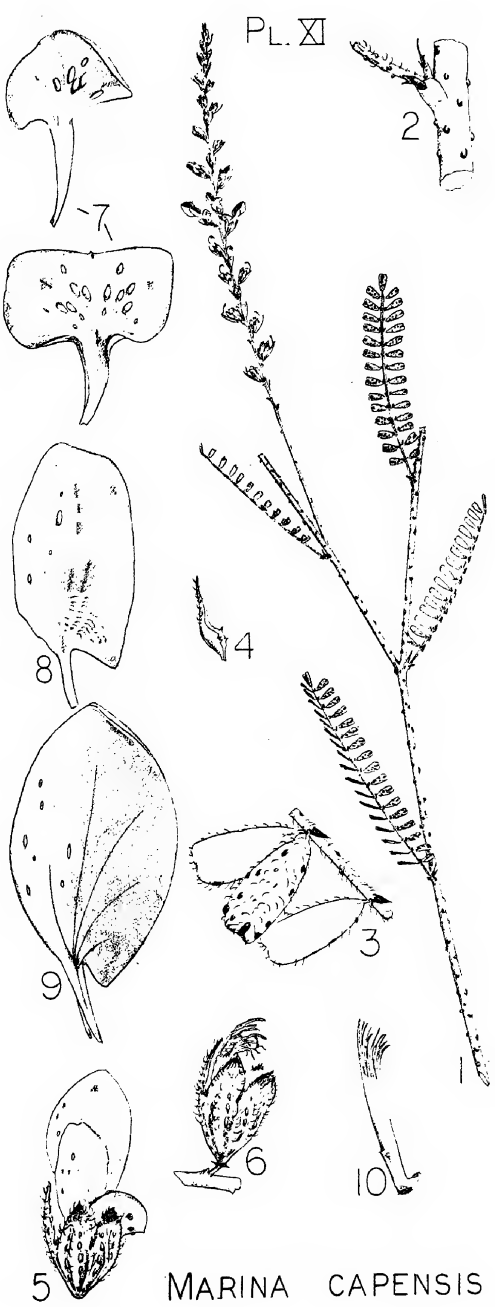
MARINA CATALINÆ

PLATE XI

Marina capensis Barneby and **M. vetula** (Bdg.) Barneby are annual herbs almost endemic to the s. half of Baja California. The close relatives of *M. capensis*, a wiry, procumbent plant with glabrous, warty stems up to 3.5 dm long, thinly pilosulous leaves, and strongly bicolored flowers, are *M. parryi, M. divaricata,* and *M. palmeri* (Plates VIII and IX), and should be compared with these. It agrees with the first two, which are found also in southern Baja California, in habit and coloring, but has more numerous leaflets and smaller flowers. The flower is nearly as small as that of the allopatric *M. palmeri,* but the more numerous, incurved-pilosulous leaflets distinguish it handily. The only known locality of *M. capensis* is near Todos Santos on the west coast of Baja California just south of the Tropic of Cancer. Near it there occurs the prostrate annual *M. peninsularis* (Plate XV), different in its pliant stems and shorter spikes. The taxonomically isolated *M. vetula* extends over the deserts from Sierra Giganta n. to the line dividing the Northern and Southern districts; and reappears in Coahuila. The stems vary from erect to incurved-ascending and from 1 to 3.5 dm in length. The stems and leaves are glabrous and glaucescent and the inconspicuous, caducous petals vary from pinkish to purplish-blue. Note the contrasting shapes of the lateral leaflets with the lanceolate terminal one, the minute, short-clawed inner petals elevated on a tall column, the deeply cleft calyx, and proportionately large, thin-textured pod, all features peculiar to *M. vetula*. — Habit × 1; detached petals (figs. 6, 7 of *M. vetula*, 7–9 of *M. capensis*) × 10; the rest × 5.

M. capensis: 1) part of flowering stem; 2) stipules and leaf-base; 3) leaflets; 4) bract; 5) flower; 6) calyx, after anthesis; 7) banner, profile and ventral views; 8) wing; 9) keel; 10) androecium.

M. vetula: 1) habit, a small plant; 2) upper 3 leaflets; 3) flower at late anthesis, showing deciduous petals and anthers; 4) fruiting calyx; 5) same, laid open; 6) banner, ventral and profile views; 7) keel-petal; 8) androecium; 9) pod.


PL. XI
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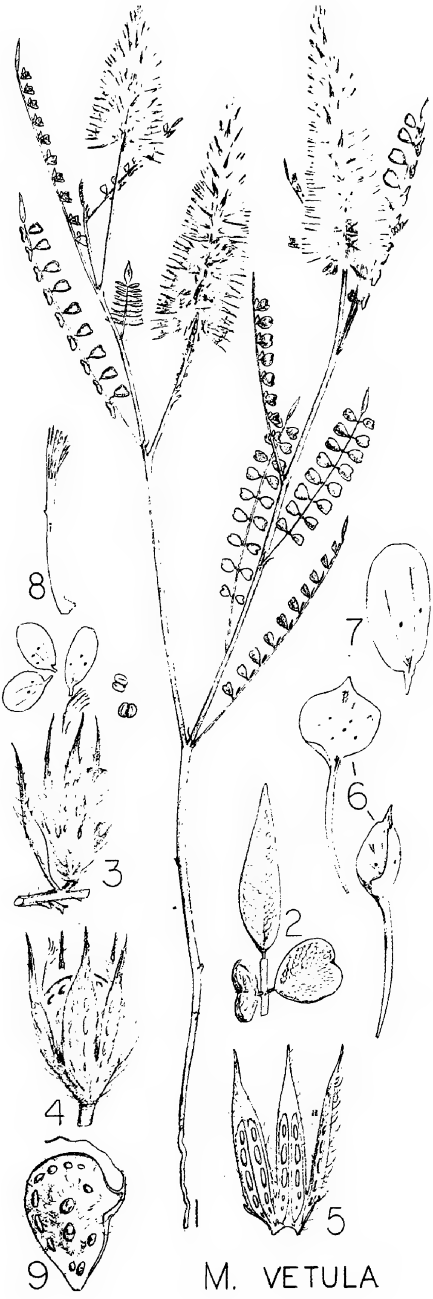
MARINA CAPENSIS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M. VETULA

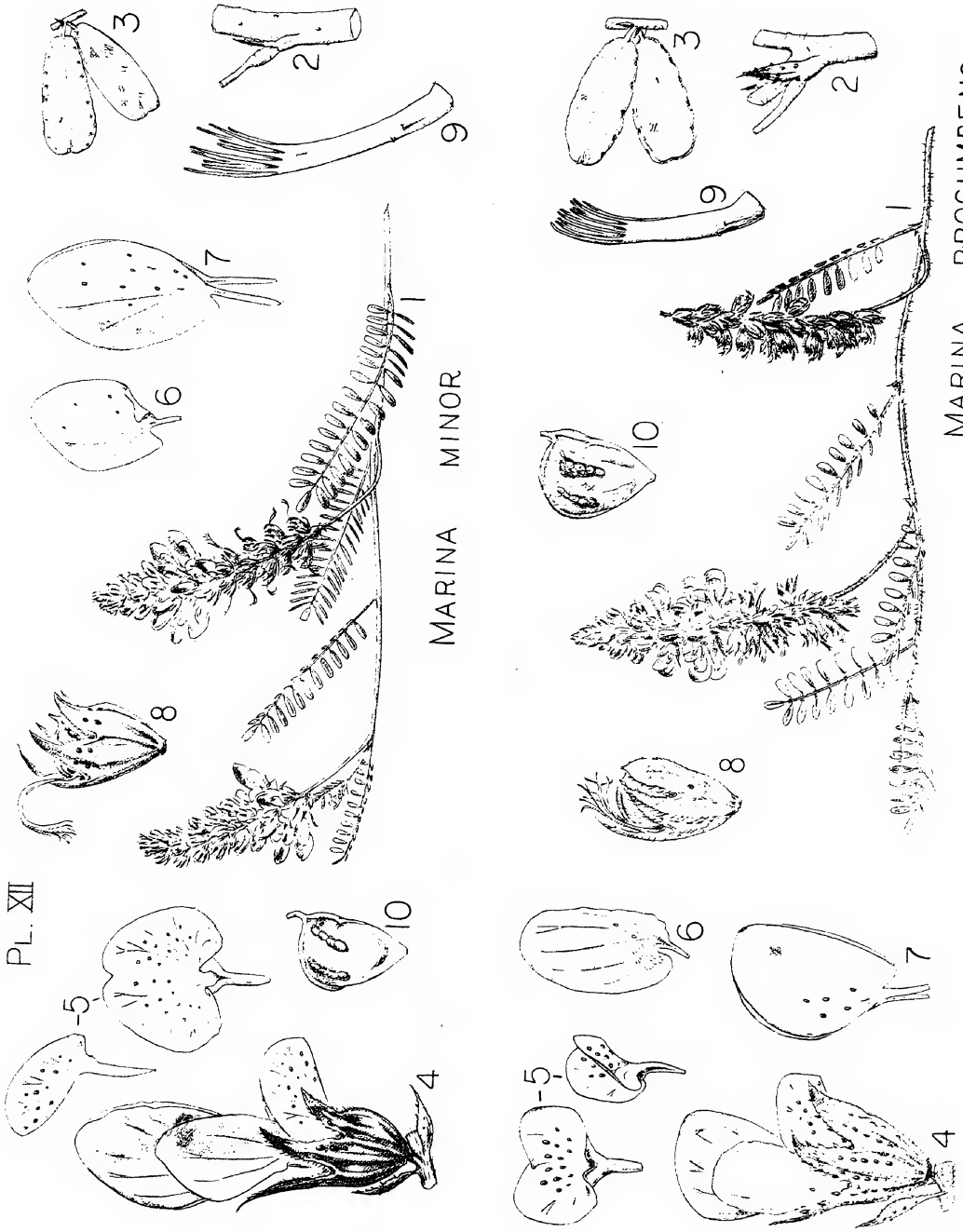
PL. XII
MARINA MINOR
MARINA PROCUMBENS
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PLATE XII

Marina minor (Rose) Barneby and **M. procumbens** (S. & M. ex DC.) Barneby are diffuse perennial herbs with glabrous leaflets but stems pubescent at least beyond the middle, and particolored flowers, the gland-sprinkled banner opening whitish but rubescent, the wings and keel whitish or pinkish in the outer half, rose-purple in the inner. The winter-flowering *M. minor* (November-February), local below 1400 m along the Sierra Madre piedmont in Sinaloa and adjoining Durango, has stiffly prostrate stems 3–9 dm long strigulose distally with subappressed hairs, flowers ascending from the axils of persistent bracts, and a glabrous calyx-tube gland-charged only about the orifice. It should be compared with nearly sympatric *M. goldmani* (Plate XIII). The relatively common *M. procumbens*, widely but interruptedly dispersed in arid grassland from the Bajío in Guanajuato s.-e. to Oaxaca and Chiapas, is the only species of its type in southern Mexico. It flowers in summer and early fall (June to November), has pliantly humifuse stems 3–5 dm long, pilosulous throughout with spreading or subretrorse hairs, bracts as a rule promptly deciduous, flowers early declined or nodding, and calyx both pilosulous and gland-charged upward from near the base. — Inflorescence × 1; the rest × 5.

M. minor: 1) top of flowering stems; 2) stipules; 3) leaflets; 4) flower; 5) banner, profile and ventral views; 6) wing; 7) keel; 8) fruiting calyx; 9) androecium; 10) pod.

M. procumbens: 1) part of flowering stem; 2) stipules; 3) leaflets; 4) flower; 5) banner, ventral and profile views; 6) wing; 7) keel; 8) fruiting calyx; 9) androecium; 10) pod.

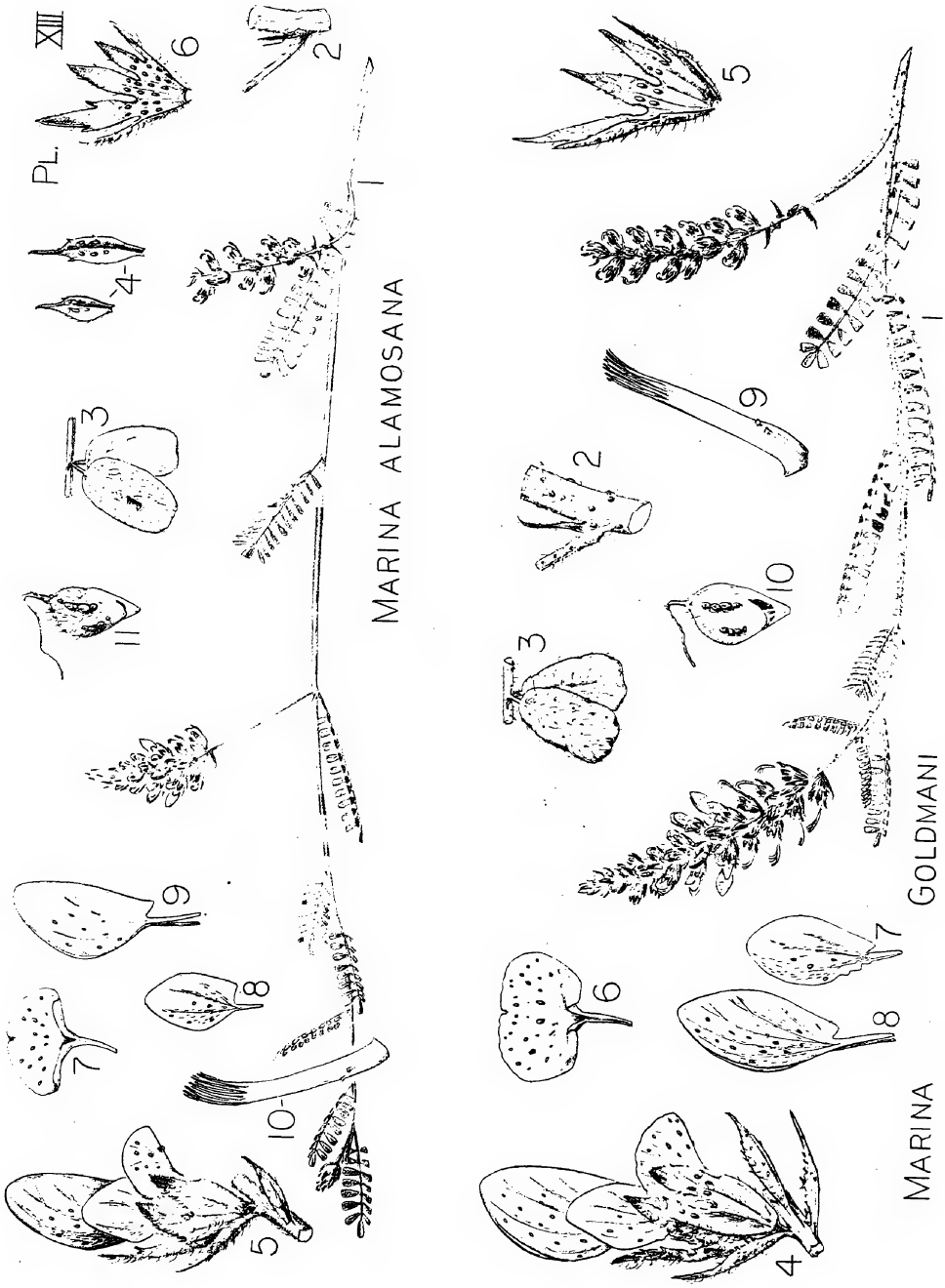

PL. XIII
MARINA ALAMOSANA
MARINA GOLDMANI

PLATE XIII

Marina alamosana (Rose) Barneby and **M. goldmani** (Rose) Barneby are endemic to the lower slopes and piedmont of the Sierra Madre at ± 250–750 m (800–2500 ft) in s.-e. Sonora and adjoining Chihuahua and Sinaloa. Both are perennial herbs flowering in fall and winter (sometimes again following rains) with radiating, procumbent stems, gray-pubescent foliage, and pallid pinkish or purplish, gland-sprinkled flowers. The relatively slender and small-flowered *M. alamosana*, confined or nearly so to the drainage of Río Mayo in Sonora and extreme w. Chihuahua, has foliage and glandless stems loosely strigulose; the leaflets are entire, minutely dotted on the back, and each calyx-interval is charged with a row of 3–4 glands, these not crowded above the middle of the tube. The closely related but coarser and ordinarily larger-flowered *M. goldmani*, which replaces *M. alamosana* in the drainage of Río Fuerte in n. Sinaloa and immediately adjoining Sonora, has foliage and gland-verruculose stems pilosulous with stiff, spreading and incurved hairs; the leaflets are distantly crenulate by impression of about 2 pairs of large marginal glands, and each calyx-interval bears 1–2, rarely 3 glands situated above the middle of the tube. — Inflorescences × 1; the rest × 5.

M. alamosana: 1) upper part of stem; 2) stipules; 3) leaflets; 4) bracts, ventral view; 5) flower + bracts; 6) calyx, laid open; 7) banner, ventral view; 8) wing; 9) keel; 10) androecium; 11) pod.

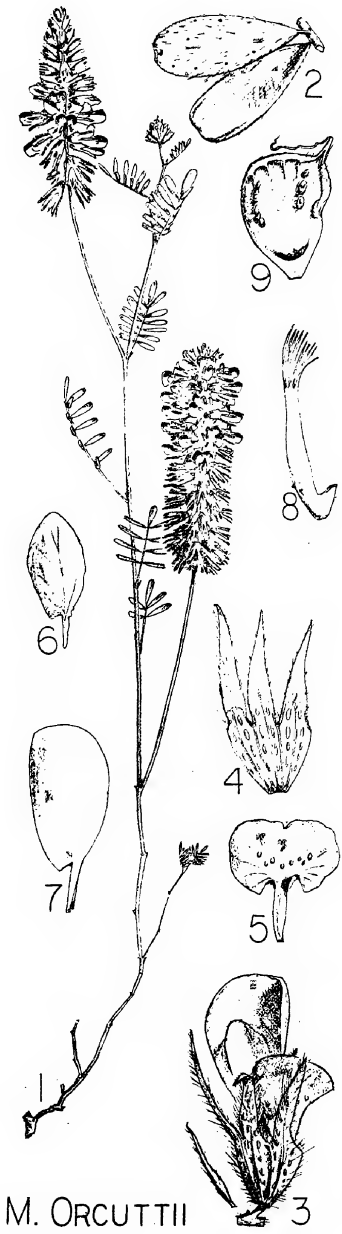
M. goldmani: 1) upper part of stem; 2) stipules; 3) leaflets; 4) flower + bracts; 5) calyx, laid open; 6) banner, ventral view; 7) wing; 8) keel; 9) androecium; 10) pod.

PLATE XIV

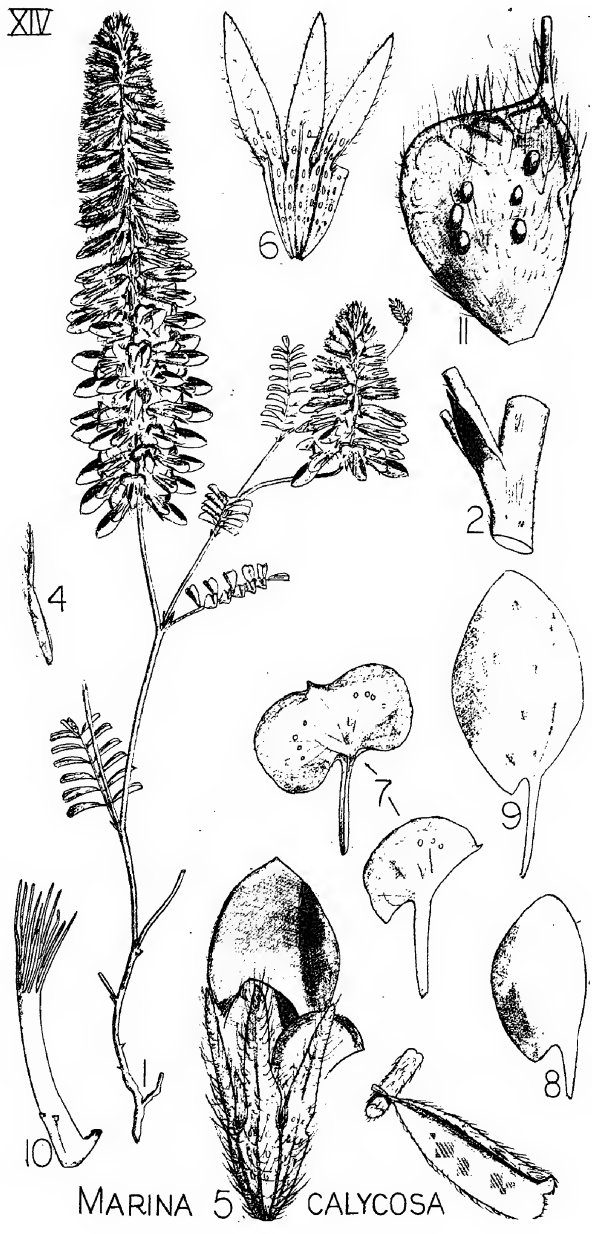
Marina calycosa (Gray) Barneby and **M. orcuttii** (Watson) Barneby are slender, loosely tufted or diffuse perennial herbs with gray-strigulose, glandless or nearly glandless foliage and racemes of nodding particolored flowers, the banner margined and the wings and keel striped or spotted along their inner edge with dull bluish purple, otherwise whitish or faintly lavender-tinged. The large-flowered *M. calycosa* has a shortly subterranean root-crown, a feature unique in the genus. It is found on dry rocky hills along the east edge and lower crests of Sierra Madre Occidental from central Chihuahua north into the hill-country drained by the Gila river in s.-w. New Mexico, s.-e. Arizona, and adjoining Sonora, where it flowers primarily in spring, but sometimes again following summer rains. The closely related *M. orcuttii* has a superficial root-crown and smaller flowers, but is otherwise similar. It is a rare plant of arid grassland near the summit of isolated desert mountain ranges near the west edge of the Sonoran Desert in Baja California. The plate shows only var. **orcuttii**, endemic to Sierra Juárez just s. of the California boundary; the taller var. **campanea**, with more numerous (mostly 8–12 pairs) leaflets in the larger leaves, is found further south, near the waist of the peninsula. — Habit × 1; pod of *M. calycosa* × 10; the rest × 5.

M. calycosa: 1) flowering stem; 2) stipules; 3) leaflet; 4) bract, lateral view; 5) flower; 6) part of calyx, from within; 7) banner, ventral and profile views; 8) wing; 9) keel; 10) androecium; 11) pod.

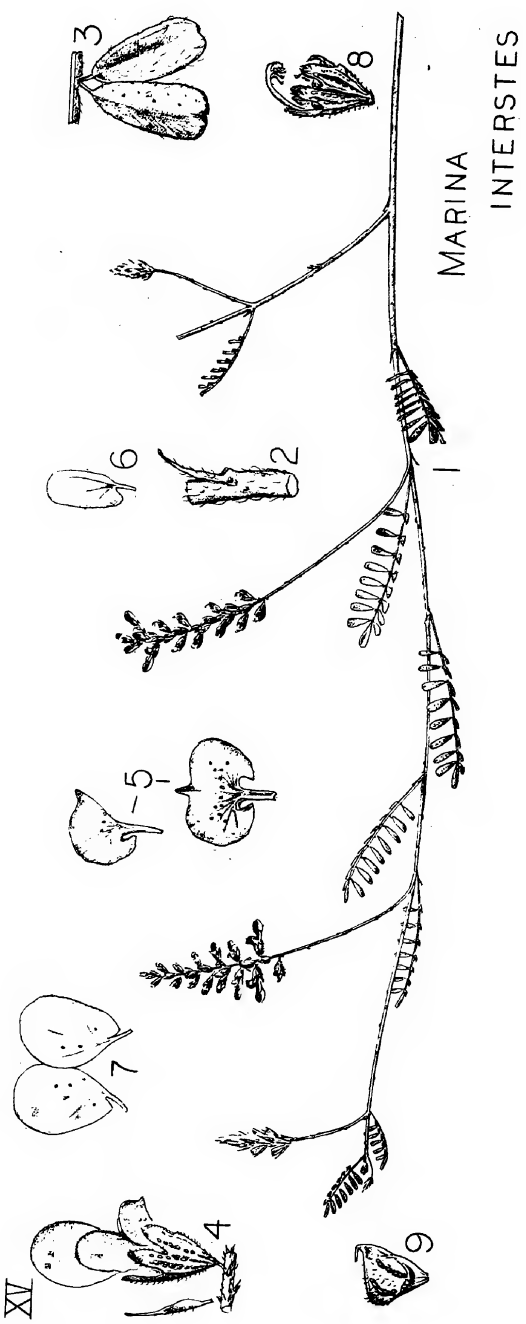
M. orcuttii var. *orcuttii*: 1) flowering stem; 2) leaflets; 3) flower + bract; 4) part of calyx, from within; 5) banner, ventral view; 6) wing; 7) keel; 8) androecium; 9) pod.



M. ORCUTTII



MARINA CALYCOSA


MARINA INTERSTES
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MARINA PENINSULARIS
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PLATE XV

Marina peninsularis (Rose) Barneby and **M. interstes** Barneby, diffuse herbs of short duration, with yellow roots, pubescent stems and herbage, and small but vividly colored flowers. Both are native to sandy or stony deserts in the southern half of Baja California peninsula, *M. interstes* local around La Paz and *M. peninsularis* more widely dispersed north to the latitude of Cedros Island and rarely east across the Gulf to coastal dunes in s. Sonora and Sinaloa. The flowers appear following rains, mostly between October and April. The stems of *M. peninsularis* are pilosulous with stiff, widely spreading or retrorse hairs mixed with small but prominent gland-tubercles, the racemes remain relatively compact even into late anthesis, the dorsal calyx-tooth is commonly twice as long as the tube, and the petals are bright magenta-purple. The stems of *M. interstes* are loosely strigulose and charged with low, lenslike or impressed glands, the racemes are relatively loose, the longest tooth of the calyx scarcely exceeds the tube, and the petals are blue-purple and a little smaller (keel-blades mostly 2–3 not 3–4 mm long). Compare also the related *M. chrysorrhiza* (Plate XVI). — Habit × 1; the × 5.

M. peninsularis: 1) upper part of stem; 2) stipules; 3) leaflets; 4) flower + bract; 5) calyx, laid open; 6) banner, profile and ventral views; 7) wing; 8) keel; 9) androecium; 10) pod.

M. interstes: 1) upper part of stem; 2) stipules; 3) leaflets; 4) flower + bract; 5) banner, profile and ventral views; 6) wings; 7) keel, laid open; 8) fruiting calyx; 9) pod.

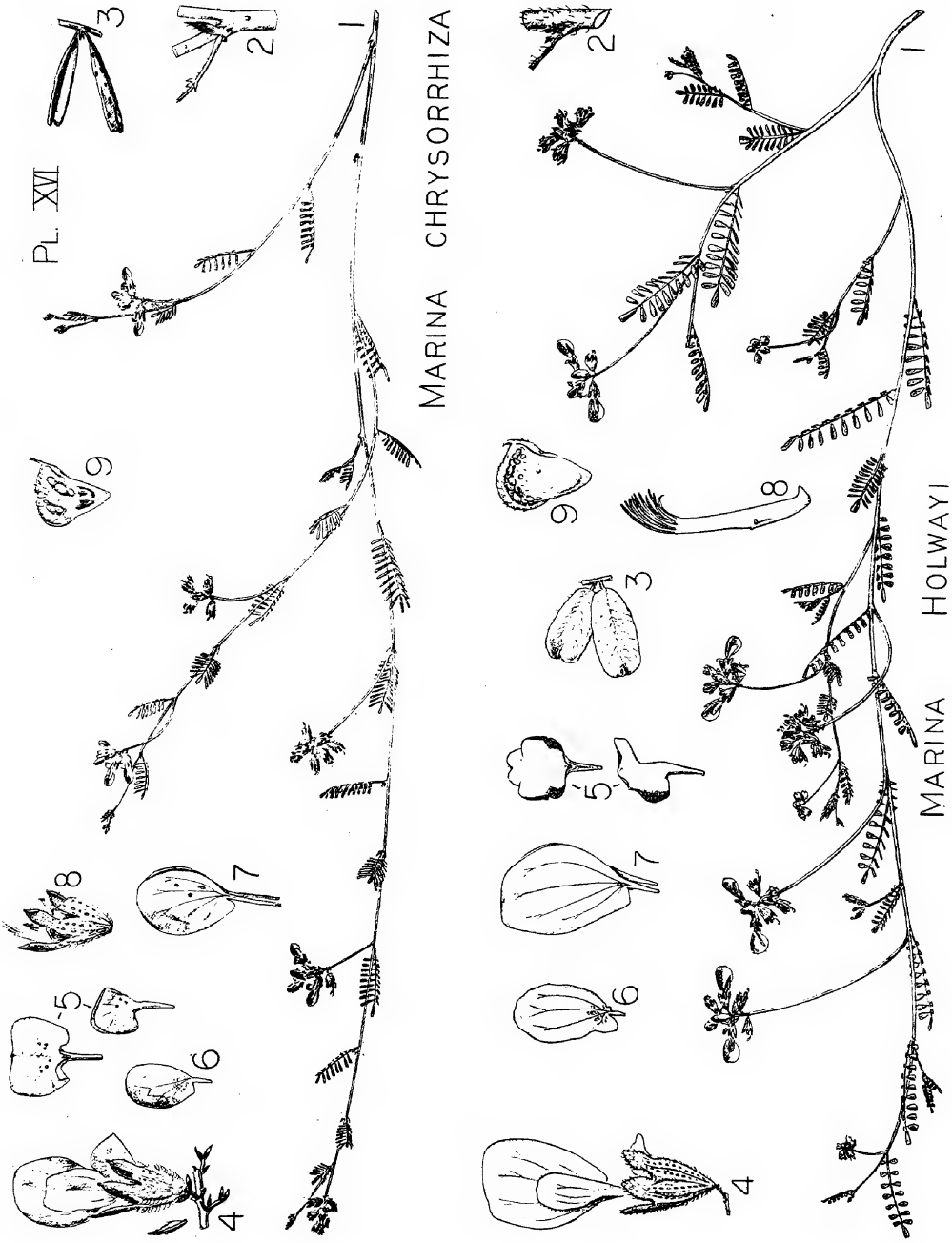

PL. XVI
MARINA CHRYSORRHIZA
MARINA HOLWAYI

PLATE XVI

Marina chrysorrhiza (Gray) Barneby and **M. holwayi** (Rose) Barneby are delicate, precociously flowering but potentially perennial herbs with slender orange taproots, the former endemic to Cape district of Baja California Sur, the latter found locally in arid grassland of the Balsas depression and central Oaxaca. Both have pliantly trailing, irregularly forking stems that radiate from the root-crown, forming mats 2–15 dm in diameter; the foliage is green but the stems are never truly glabrous; the small flowers particolored, with a pale stripe along the outer edge of banner and keel, the rest purple. The banner of *M. chrysorrhiza* has a golden, gland-sprinkled eye surrounded by a purple border, that of *M. holwayi* is glandless and opens white except for the often purple-tipped lobes of the blade. — Habit × 1; the rest × 5.

M. chrysorrhiza: 1) top of flowering stem; 2) stipules; 3) leaflets; 4) flower + bract; 5) banner, ventral and profile views; 6) wing; 7) keel; 8) fruiting calyx; 9) pod.

M. holwayi: 1) top of flowering stem; 2) stipules; 3) leaflets; 4) flower; 5) banner, ventral and profile views; 6) wing; 7) keel; 8) androecium; 9) pod.

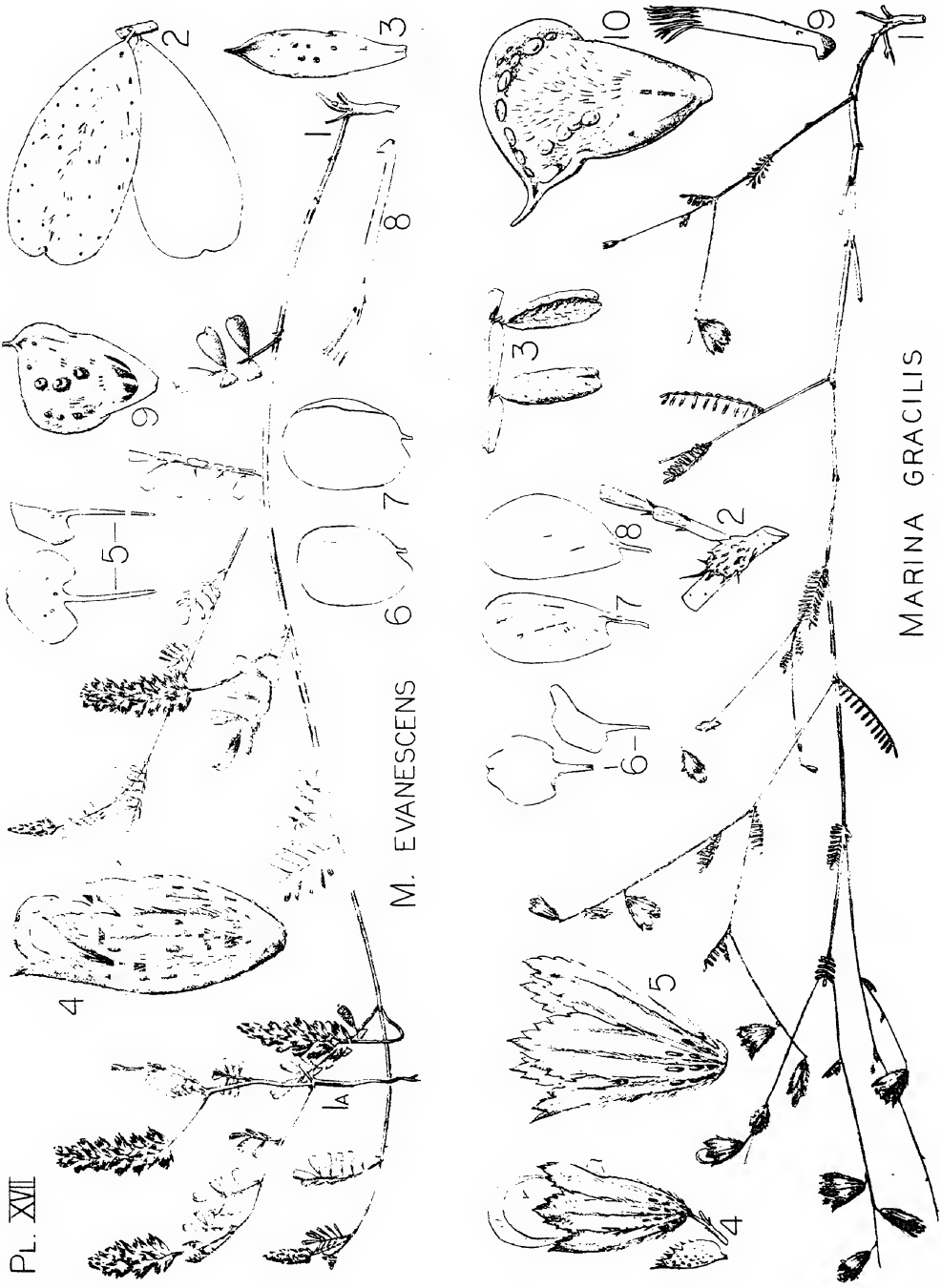

PL. XVII
M. EVANESCENS
MARINA GRACILIS

PLATE XVII

Marina evanescens (Brandegee) Barneby and **M. gracilis** Liebmann exhibit two extreme stages of floral reduction in Amorpheae. Both species flower as annuals, but may persist into a second year. The wiry stems and minute, thick-textured leaflets of *M. gracilis* are glabrous, the scarcely exserted epistemonous petals bluish-lilac and caducous. Note the accrescent calyx with pilose ribs and sharply toothed lobes, unique in the genus. The species is found in thin stony soil of arid grassland in the Balsas Depression of southern Mexico, in central Oaxaca, and in the valley of Río Motagua in southeastern Guatemala, flowering in late summer and on into early winter. The foliage of *M. evanescens* is strigulose and the minute petals vary from lavender or pinkish to vivid magenta-purple. Note the reduced pentandrous androecium, analogous to that of *Dalea* sect. *Kuhnistera*, though cleft into a shorter tassel. The range of *D. evanescens* extends over the deserts of Baja California to one point on the Sonoran coast near Guaymas. The plants flower irregularly, from October through April, following rain. — Habit × 1; leaflets and stipules × 5; the rest × 10.

M. evanescens: 1) stem of robust phase; 1a) diminutive annual phase; 2) leaflets; 3) bract, ventral view; 4) flower; 5) banner, ventral and profile views; 6) wing; 7) keel-petal; 8) androecium; 9) pod.

M. gracilis: 1) habit; 2) stipules + base of leaf-stalk; 3) leaflets; 4) flower + bract; 5) fruiting calyx; 6) banner, ventral and profile views; 7) wing; 8) keel; 9) androecium; 10) pod.

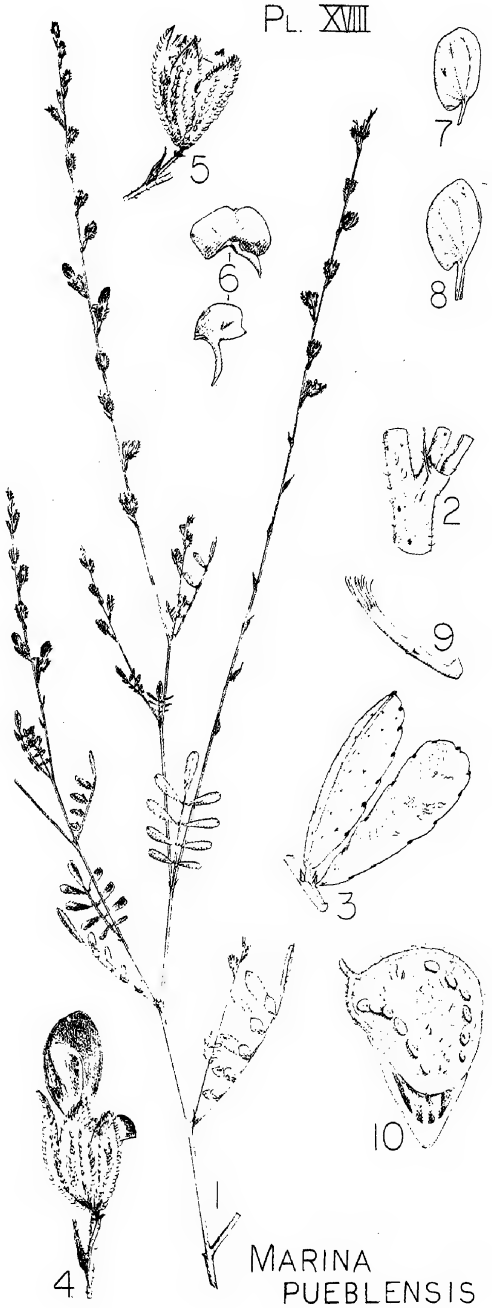
PLATE XVIII

Marina melilotina Barneby and **M. pueblensis** (Bdg.) Barneby are wiry, fall-flowering annuals with relatively few pairs of leaflets, pectinately ciliolate calyces, and open racemes of vivid magenta-purple flowers. The plants occur colonially in arid scrub and grassland below 1600 m in the eastern part of the Balsas Depression and in the Tehuacán desert, in Morelos and adjoining Puebla and Guerrero, and in northern Oaxaca. The tall, erect *M. melilotina* is glabrous below the pedicels, has large, showy flowers, and bracts that fall away early from the swelling flower-buds. The more slender, commonly diffuse, tiny-flowered *M. pueblensis* has puberulent stems and raceme-axis, and the brown, glumaceous bracts persist in place even after the pedicels and ripe fruits are shed. — Habit × 1; pods × 10; the rest × 5.

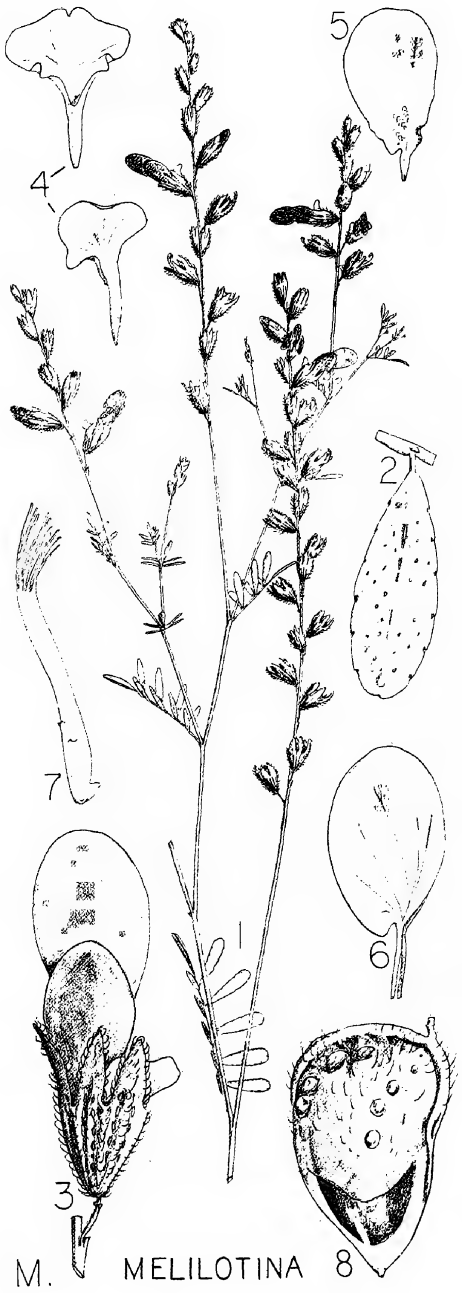
M. melilotina: 1) branch of panicle; 2) leaflet, dorsal view; 3) flower; 4) banner, ventral and profile views; 5) wing; 6) keel; 7) androecium; 8) pod.

M. pueblensis: 1) branch of panicle; 2) stipules + leaf-base; 3) leaflets; 4) flower; 5) fruiting calyx; 6) banner, ventral and profile views; 7) wing; 8) keel; 9) androecium; 10) pod.

PL. XVIII



MARINA PUEBLENSIS



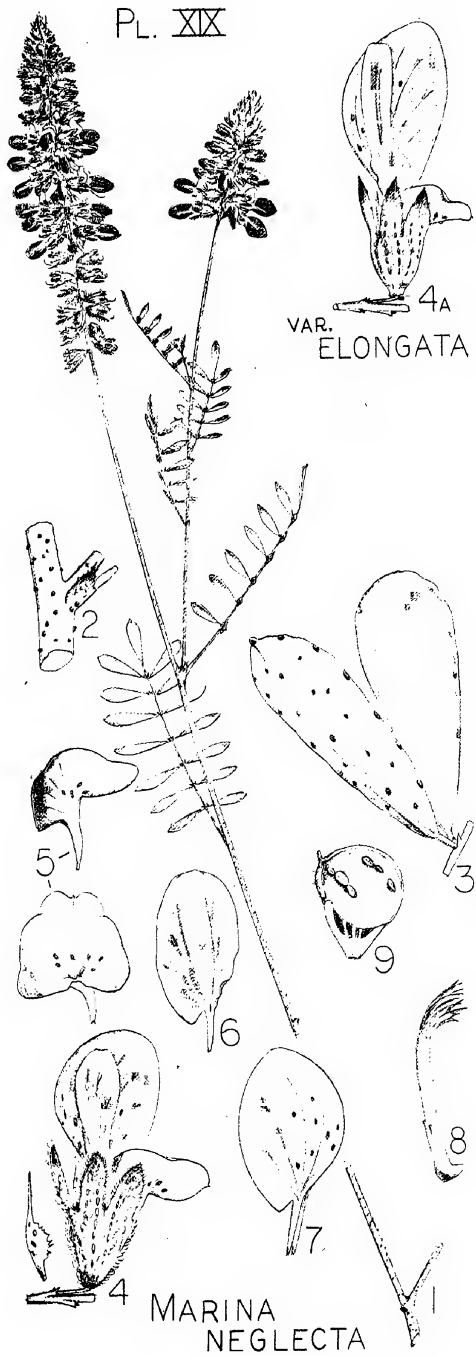
M. MELILOTINA

PLATE XIX

Marina neglecta (B. L. Robins.) Barneby and **M. spiciformis** (Rose) Barneby, species of dry, brushy and grassy places, mostly below 2000 m, endemic to Mexico southward from Jalisco and Guanajuato, are alike in their glabrous leaves and vivid magenta-purple flowers; both flower in the dry season, sometimes sharing the same habitat, but are easily told apart by the duration of the root, the number of leaflets, the size of the flower, and other details. The stems of *M. neglecta*, found here and there, often as a roadside weed, on both slopes of the Transverse Volcanic Belt and extending thence into central Oaxaca, rise from a perennial root to a height of 3–15 dm. The leaflets are mostly 4–8 pairs, the flowers ± 7 mm long at full anthesis, and the blade of the gland-sprinkled banner is closed across the base to form a shallow well. The calyx of the common var. **neglecta** is pectinately ciliolate; that of the often taller, more loosely flowered var. **elongata** (Rose) Barneby is glabrous. The less common *M. spiciformis* is known only from the Balsas Depression and from one isolated station in Chiapas. Its root is annual, the stems rarely exceed 4 dm in height, the leaflets are 2–4 pairs. The flower is nearly one half smaller with a glandless banner open at the base. — Habit × 1; the rest × 5.

M. neglecta: 1) flowering branchlet of var. *neglecta*; 2) stipules; 3) leaflets; 4) flower of var. *neglecta*; 4a) flower of var. *elongata*; 5) banner, profile and ventral views; 6) wing; 7) keel; 8) androecium; 9) pod.

M. spiciformis: 1) flowering branchlet; 2) stipules; 3) leaflets; 4) flower + bract; 5) banner, 2 ventral and 1 profile view; 6) wing; 7) keel; 8) fruiting calyx; 9) pod.


PL. XIX
4A
VAR.
ELONGATA
2
5
3
9
6
8
7
4
1
MARINA
NEGLECTA

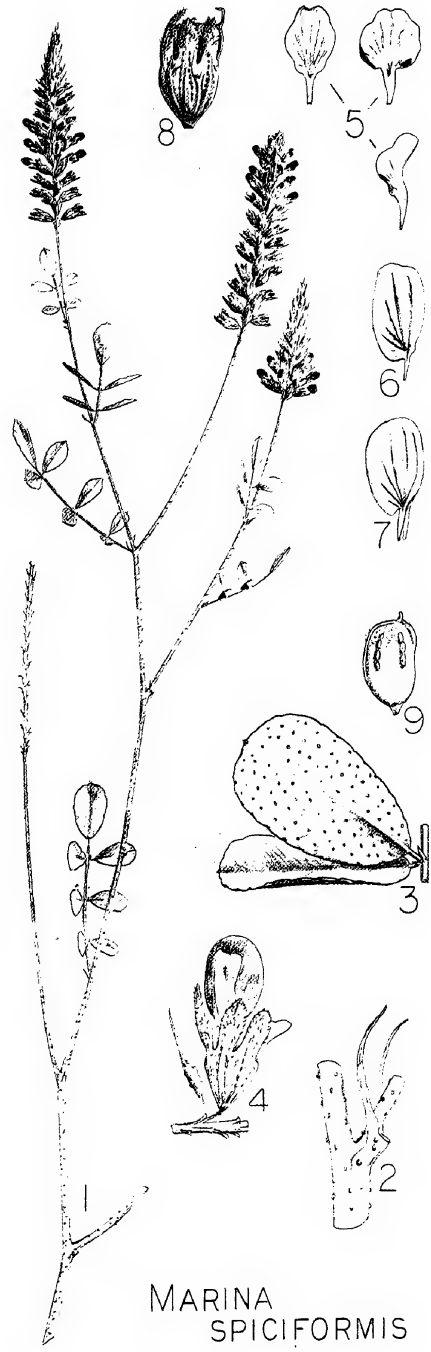

8
5
6
7
9
3
4
2
1
MARINA
SPICIFORMIS

PLATE XX

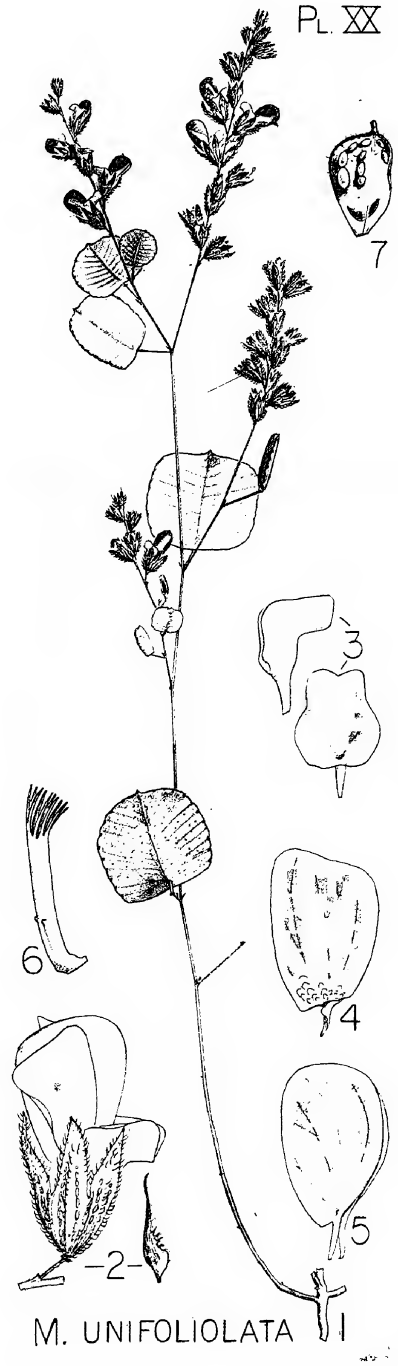
Marina greenmaniana (Rose) Barneby and **M. unifoliolata** (Robins. & Greenm.) Barneby are slender wiry annuals of southern Mexico, of brushy grasslands in and below the oak-belt, flowering in fall and winter; they are the only species of *Marina* with leaves reduced to one suborbicular leaflet (exceptionally trifoliolate). The foliage of both is green and glabrous or nearly so, and the flowers, except for the small white banner, are vivid magenta-purple. The more robust and larger-flowered *M. unifoliolata* is dispersed around the Balsas Depression from southeastern Mexico State and western Guerrero w. through Michoacán into the Lerma valley in western Jalisco; so far as known its calyx is pectinately ciliate and its pod pilosulous. The similar but smaller, often diminutive *M. greenmaniana*, with calyx and pod pubescent like those of its relative in var. **greenmaniana** but glabrous in var. **muelleri** Barneby, apparently replaces *M. unifoliolata* around the eastern edge of the Balsas Depression and extends s.-e. into central Oaxaca. — Stems + inflorescence × 1; the rest × 5.

M. greenmaniana (1–9, var. *greenmaniana*; 1a, 3a, 9a, var. *muelleri*): 1, 1a) habit; 2) cauline leaf; 3, 3a) flowers + bract; 4) fruiting calyx; 5) banner, ventral and profile views; 6) wing; 7) keel; 8) androecium, laid open and profile; 9, 9a) pods.

M. unifoliolata: 1) habit; 2) flower + bract; 3) banner, profile and ventral views; 4) wing; 5) keel; 6) androecium; 7) pod.

MARINA
GREENMANIANA

PL. XX



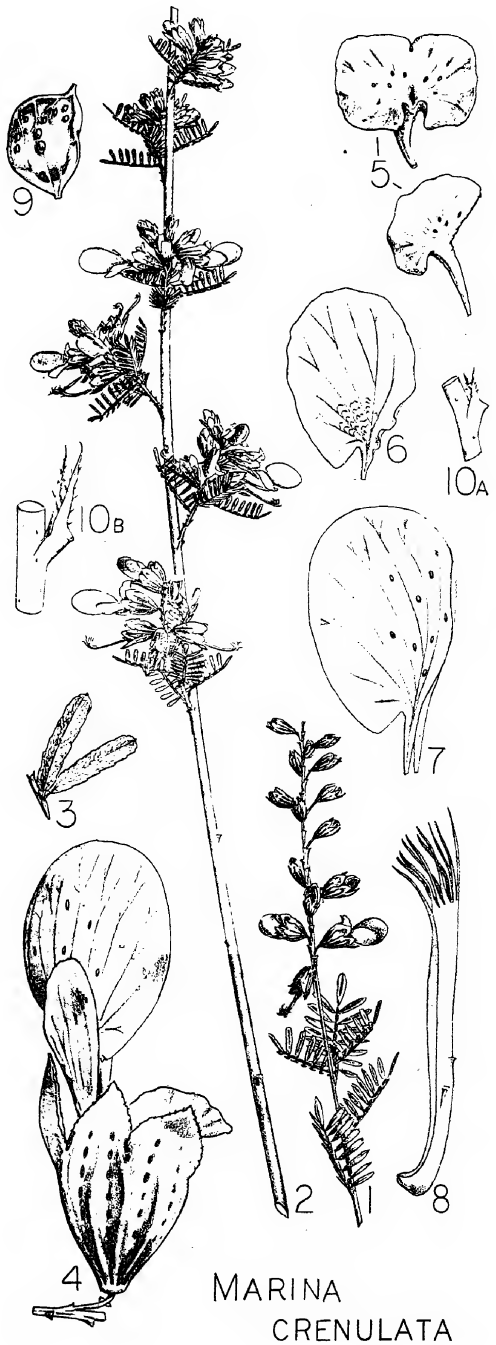
M. UNIFOLIOLATA

PLATE XXI

Marina crenulata (H. & A.) Barneby and **M. sarodes** Barneby are much alike in the form of the flower and pod. Both are entirely glabrous, with green leaflets paler beneath and (except for the small white or partly white banner) petals of vivid rose- or magenta-purple; but they differ greatly in duration, habit, and stature. The tall and relatively common *M. crenulata* has one or several erect, wandlike, lignescent stems mostly 1–2 meters tall. In late fall it bears a few flowers in loose spikes terminal to the main axis or to branches of a sparsely furnished terminal panicle, and subsequently many short, few-flowered, sometimes subumbellate spikes produced during the dry winter months on leafy spurs arising from the axils of drought-deciduous cauline leaves. The species ranges along the foothills of the Pacific slope in Mexico, in grassland, thorn-forest, and thin oak woodland, from southern Sonora and adjacent Chihuahua to western Jalisco, inland along the lower Santiago River nearly to Guadalajara, and southeastward into western Oaxaca, where represented by var. **stipulacea** (fig. 10b). The rare *M. sarodes*, known as yet only from the type-locality in Nayarit (near Compostela), is a tall slender annual of the oak-belt, with airily branching panicle of spikes, the leaves suddenly reduced in the inflorescence. Branchlets × 1; leaflets × 3; the rest × 5.

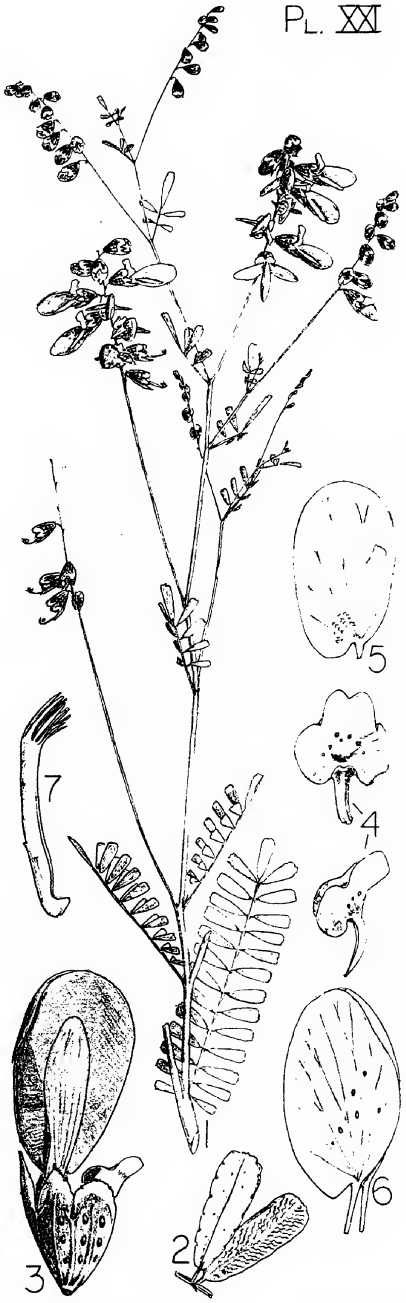
M. crenulata: 1) an early raceme, terminal to main stem, in flower in October; 2) part of a wand-stem, in flower in February after the cauline leaves have dropped; 3) leaflets; 4) flower; 5) banner, ventral and profile views; 6) wing; 7) keel; 8) androecium; 9) pod; 10a) stipules of var. *crenulata*; 10b) stipules of var. *stipulacea*.

M. sarodes: 1) branch of panicle; 2) leaflets; 3) flower; 4) banner, lateral and ventral views; 5) wing; 6) keel; 7) androecium.

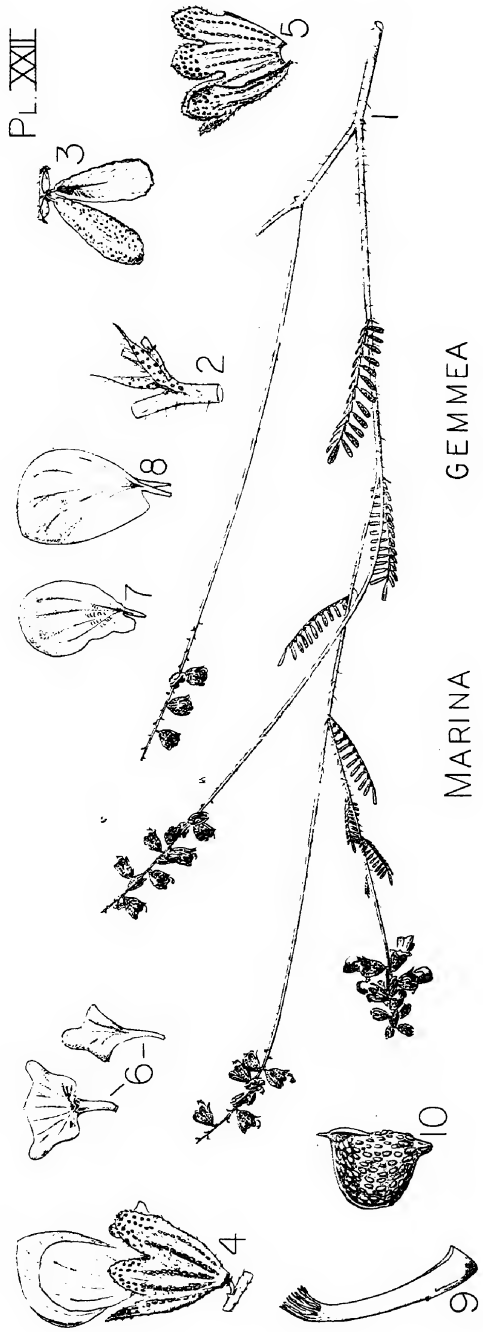


MARINA CRENULATA

PL. XXI



MARINA SARODES


PL. XXII
MARINA GEMMEA

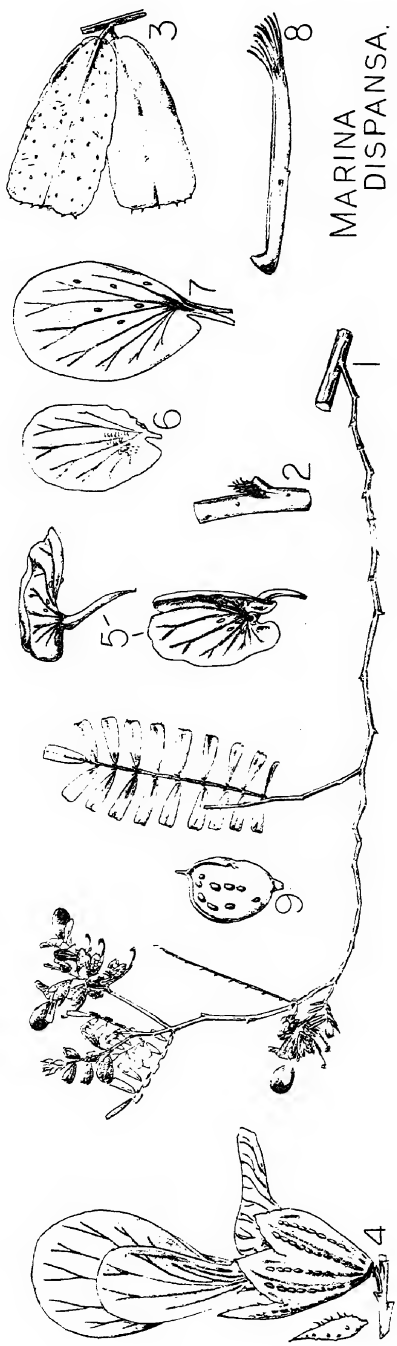

MARINA DISPANSA.

PLATE XXII

Marina dispansa (Rydb.) Barneby and **M. gemmea** Barneby, rare species of s.-w. Mexico, each known from but one collection, represent different series within sect. *Marina*. The former is a diffuse, twiggy shrub with bicolored flowers, the whitish, coarsely veined banner contrasting with magenta-violet wings and keel, and is closely related to *M.* (ser. *Crenulatae*) *crenulata* (Plate XXI), differing in habit and several minor details. It was found in oakwoods at ± 1400 m near Talpa de Allende in extreme w. Jalisco, flowering in early March. The diffuse, herbaceous perennial *M. gemmea* forms by itself the monotypic ser. *Gemmeae* characterized by the densely gland-sprinkled stipules and calyx-teeth, and the uniformly pustular pod; it is in many respects similar to *M.* (ser. *Unifoliolatae*) *holwayi* (Plate XVI), but has coarser, stiffer stems and longer racemes of flowers. It was collected at 430 m in the valley of Rio Tepalcatepec w. of Nueva Italia, Michoacán, in late flower in mid-November, and is to be sought elsewhere in arid grassland on the floor of the Balsas Depression. — Habit × 1; the rest × 5.

M. dispansa: 1) branchlet at late anthesis, after most cauline leaves are shed; 2) stipules; 3) leaflets; 4) flower + bract; 5) banner, profile and ventral views; 6) wing; 7) keel; 8) androecium; 9) pod.

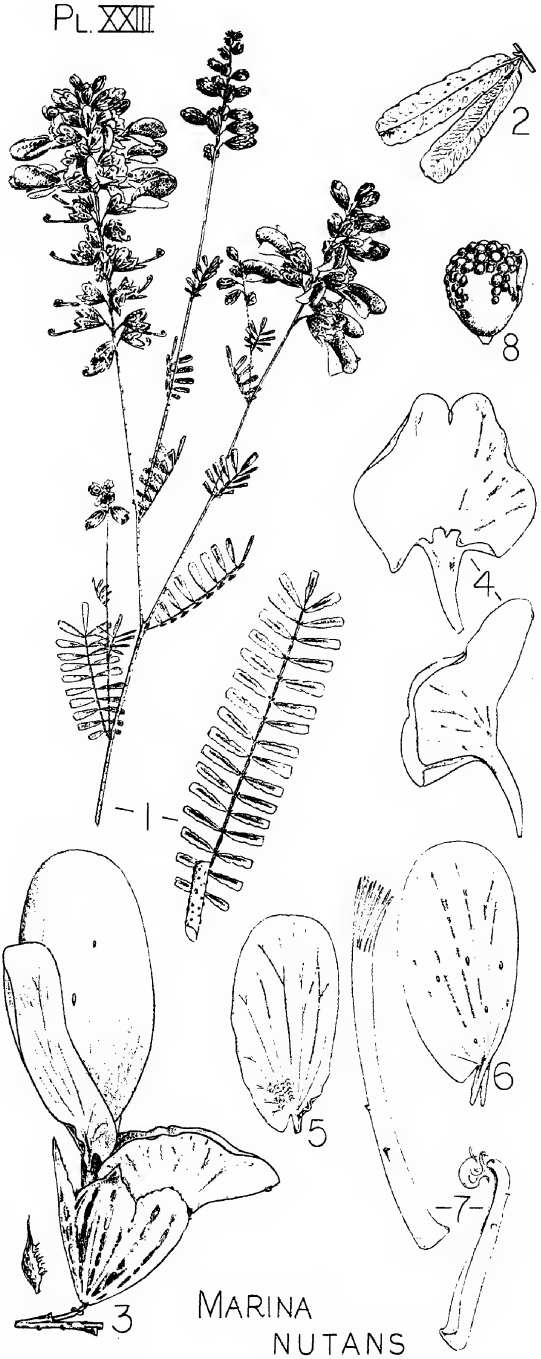
M. gemmea: 1) top of flowering stem; 2) stipules; 3) leaflets; 4) flower; 5) calyx, laid open; 6) banner, ventral and profile views; 7) wing; 8) keel; 9) androecium; 10) pod.

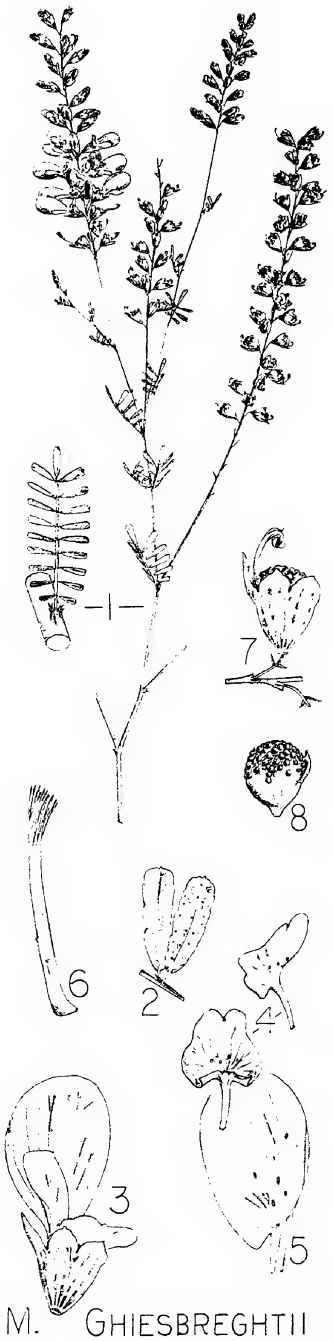
PLATE XXIII

Marina nutans (Cav.) Barneby and **M. ghiesbreghtii** Barneby are Mexican, entirely glabrous, alike in their vivid magenta- or rose-purple flowers that appear in fall and winter, and in details of the peltate banner and the small nutlike pod densely pustular above the middle and shortly crested on the back. The handsome, large-flowered *D. nutans* is a polypodial perennial herb that may become weakly suffruticose in age; the warty stems are erect and commonly about a meter tall, but can attain two meters and can be less than one. It is widely dispersed in the pine-oak belt of south-central Mexico, especially common through the Neovolcanic Belt westward from Morelos and extending south into the highland of central Oaxaca, and north around the edges of the central plateau, on the Pacific slope to southern Chihuahua and on the Gulf slope to extreme southern Nuevo León. The inflorescence varies greatly in density and number of flowers. The stature of the similar but smaller-flowered *D. ghiesbreghtii* is not surely known; apparently it is a shrub resembling *D. diffusa* Moric. in habit, with numerous pliant and smooth branchlets arranged in an ample panicle. The species is endemic to the Sierra Madre del Sur, but known from only a few collections, from Chiapas and Guerrero. Inflorescences + main cauline leaves × 1; leaflets × 3; the rest × 5.

M. nutans: 1) branchlet from panicle + main cauline leaf; 2) leaflets; 3) flower + bract; 4) banner, ventral and profile views; 5) wing; 6) keel; 7) androecium fully expanded and coiled after anthesis; 8) pod.

M. ghiesbreghtii: 1) branchlet from panicle + main cauline leaf; 2) leaflets; 3) flower; 4) banner, ventral and profile views; 5) keel; 6) androecium; 7) fruiting calyx; 8) pod.


PL. XXIII
2
8
4
1
5
6
7
3
MARINA
NUTANS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M. GHIESBREGHTII

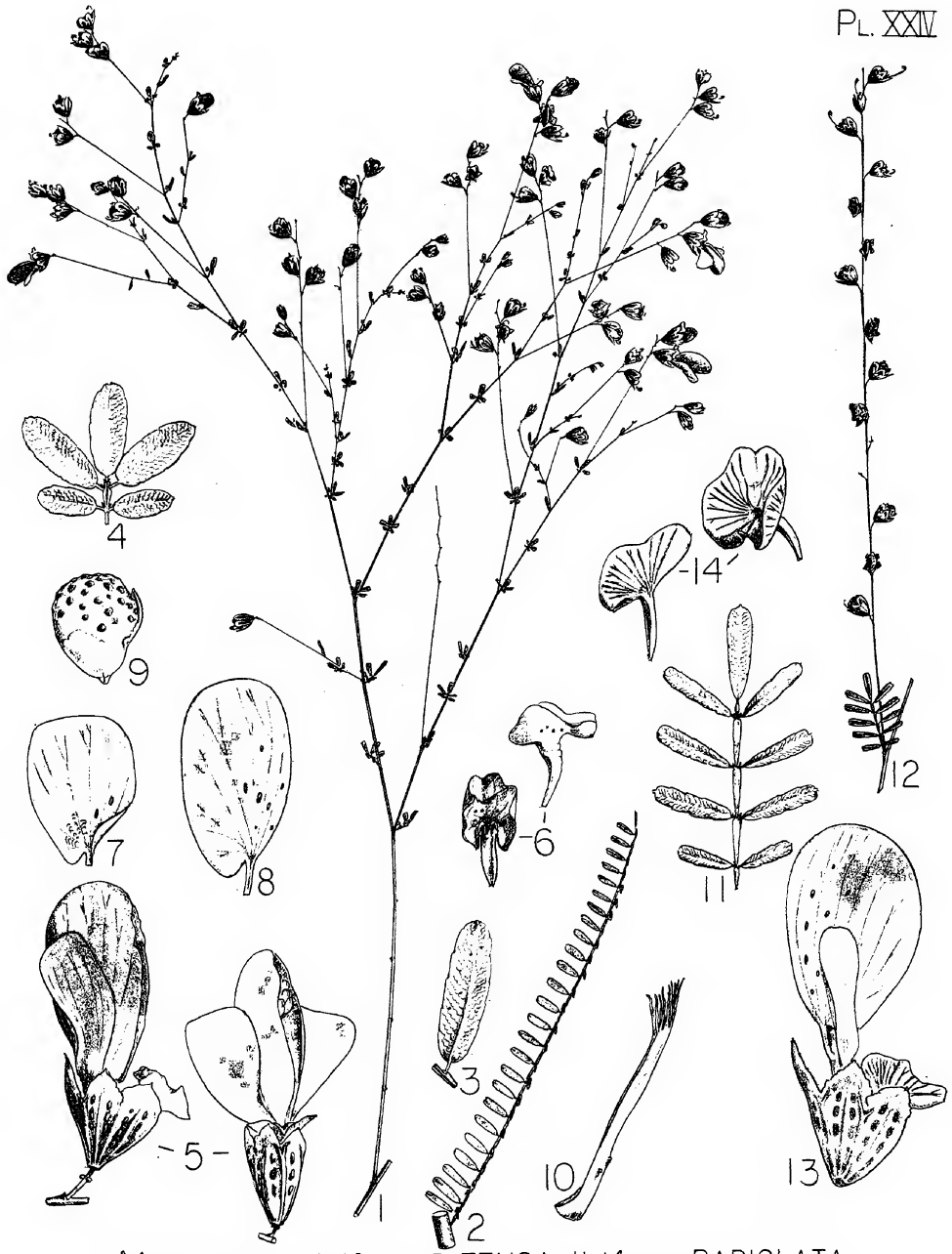
PLATE XXIV

Marina diffusa (Moric.) Barneby becomes when full grown a round-headed shrub up to 1–2.5 m tall, wholly glabrous, with one to several trunks 1–3 cm in diameter and many black-purple, glaucous stems elaborately ramified upward into a cloud of pliant branchlets and capillary flower-stalks. The frondose cauline foliage (fig. 2) developed during summer growth is deciduous in fall, and in the dry season, as the flowers mature, the plant is commonly naked except for the minute paucifoliolate leaves in the panicle. The flowers, except for the white-tipped banner rich magenta-violet or dark plum-purple, are fugitive, the petals falling almost as they expand. The species is widely dispersed along the Neovolcanic Belt in Mexico from southeastern México to Nayarit, thence north along the Pacific slope to Sonora and just into extreme southern Arizona, and southeast, becoming rarer, along the Sierra Madre del Sur to Oaxaca and Guatemala. In the Lerma valley downstream from Lago Chapala *M. diffusa* is represented by var. **radiolata** Barneby, differing in more numerous flowers and leaflets, and a prominently striped vexillum. — Inflorescence and cauline leaf × 1; the rest × 5.

var. *diffusa*: 1) branchlet; 2) main cauline leaf; 3) leaflet from the last, dorsal view; 4) leaf from panicle; 5) flower, profile and dorsal views; 6) banner, ventral and profile views; 7) wing; 8) keel; 9) pod; 10) androecium.

var. *radiolata*: 11) leaf from panicle; 12) raceme central to main division of panicle; 13) flower; 14) banner, ventral and profile views.

PL. XXIV



M. DIFFUSA 1–10 VAR. DIFFUSA, 11–14 VAR. RADIOLATA

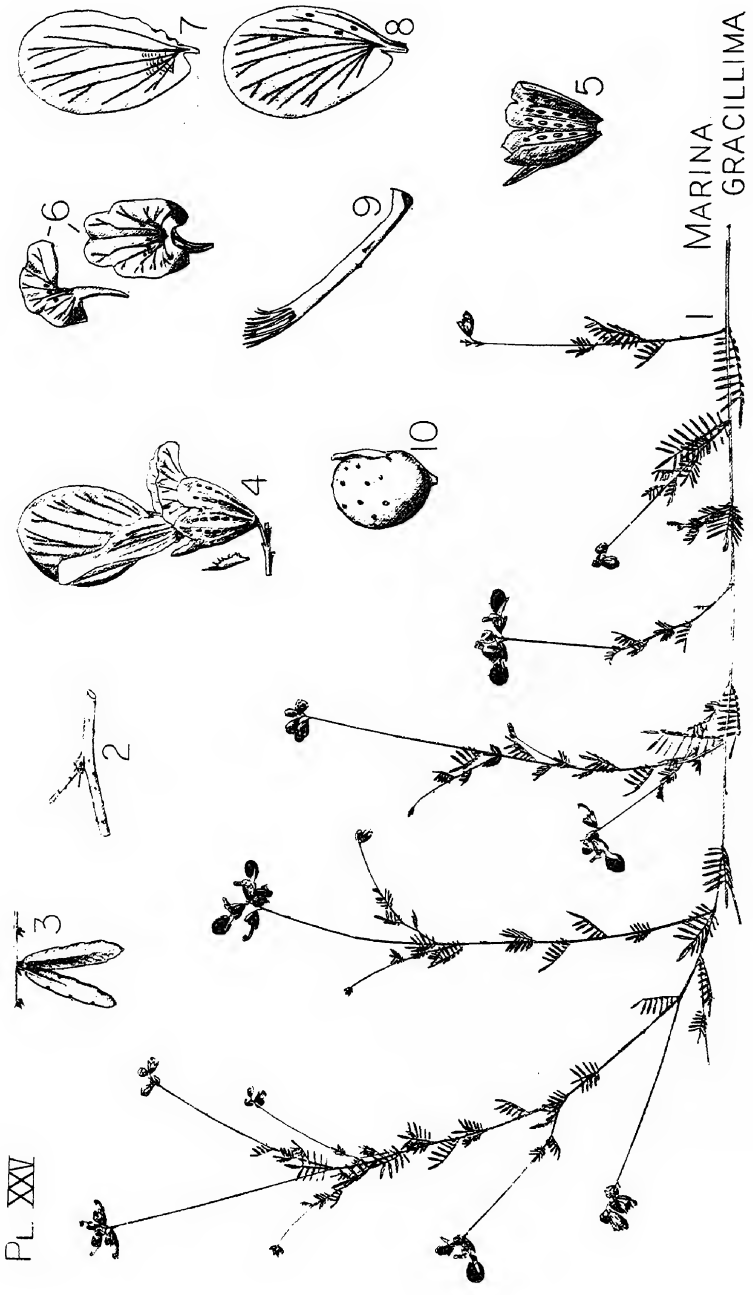

PL. XXV
MARINA GRACILLIMA
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PLATE XXV

Marina gracillima (Wats.) Barneby inhabits grassy plains and canyon benches in the neighborhood of Guadalajara, Jalisco, where it may be found in flower from September onward. The plants are entirely glabrous; the flowers except for a heavily striped banner that opens whitish are vivid magenta-purple. The main stems radiate from the crown of a stout perennial root, spreading over the ground a carpet up to 1.5 m in diameter of exceptionally delicate and elaborate pinnae. Each main axis terminates in a small, open panicle, but most of the few-flowered, subumbellate racemes are borne aloft on filiform branchlets, either simple or distally forked, which arise from axils of the primary leaves. The habit of growth is unique in the genus. — Stem × 1; the rest × 5.

1) upper part of stem; 2) stipules; 3) leaflets; 4) flower + bract; 5) calyx, laid open; 6) banner, profile and ventral views; 7) wings; 8) keel; 9) androecium; 10) pod.

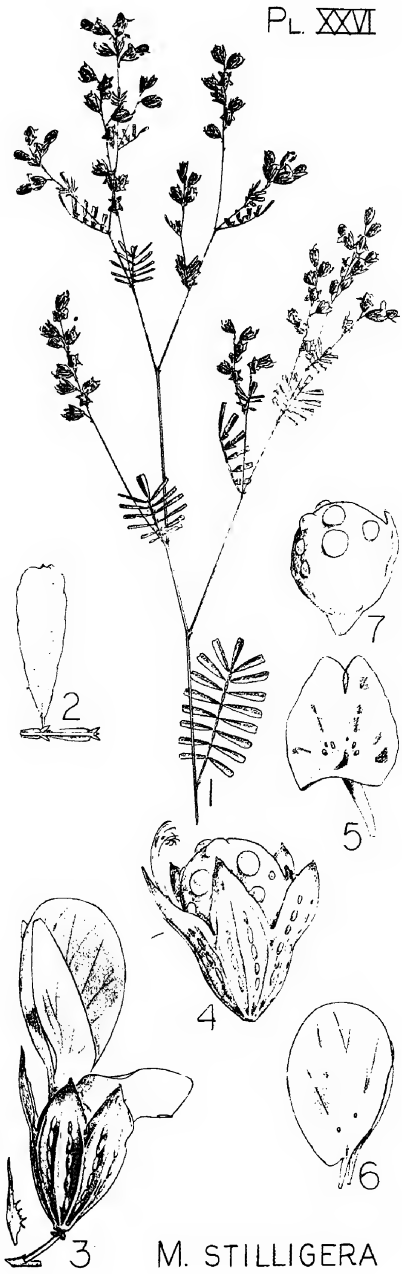
PLATE XXVI

Marina minutiflora (Rose) Barneby (left) and **M. stilligera** Barneby (right), filiform-wiry, perfectly glabrous annuals with orange roots, green foliage, and tiny magenta-violet flowers, of low elevations in southern Mexico, flowering in the late fall and winter months. The usually calciphile *M. minutiflora*, with remotely few-flowered racemes and a pod covered with very numerous small glands, extends from Morelos into central Oaxaca. The closely related *M. stilligera* is found chiefly on volcanic soils, has more crowded racemes of more numerous flowers, and a pod charged with only a few, very large fragile glands that release a yellow oil when pressed; its range extends from Morelos w. through the Neovolcanic Belt into Michoacán. Note also the differently shaped vexilla. Branchlets × 1; leaflets × 5; flowers and pods × 10.

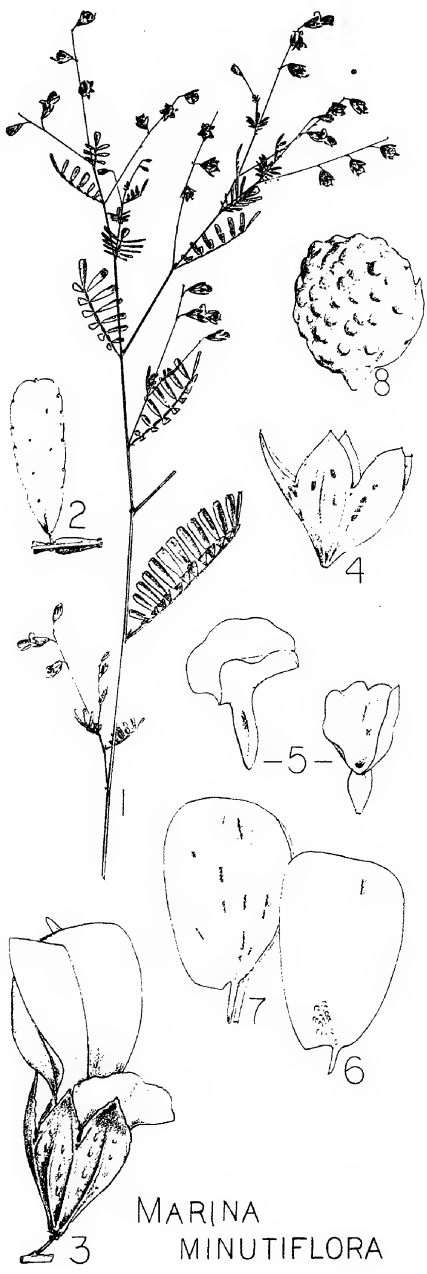
M. minutiflora: 1) flowering branch; 2) leaflet, dorsal view; 3) flower; 4) fruiting calyx; 5) banner, ventral and profile views; 6) wing; 7) keel; 8) pod.

M. stilligera: 1) flowering branch; 2) leaflet, dorsal view; 3) flower + bract; 4) fruiting calyx + pod; 5) banner, ventral view; 6) keel; 7) pod.

PL. XXVI



M. STILLIGERA



MARINA MINUTIFLORA

PLATE XXVII

Marina grammadenia Barneby, an uncommon shrub of oak woodland on the Pacific slope of western Jalisco and northwestern Durango, to be expected in Sinaloa and Nayarit. The plants reach a stature of 2 m; they are quite glabrous, with rather stiff, livid branchlets giving rise late in the dry season to very numerous, few-flowered racemes of fugitive purple flowers arranged in ample panicles. In habit of growth *M. grammadenia* resembles *M. diffusa*, but differs in the much larger banner with blade open at base, not joined across the top of the claw to form a cornet. The widespread *M. scopa* has a similarly formed but smaller banner; but it is monopodial and monocarpic, and the leaflets of the main leaves are many more in number. The sympatric, also shrubby *M. crenulata* has a similarly formed calyx, but differs greatly in its virgate habit of growth, combined with a banner as in *M. diffusa* and once again more numerous leaflets. Note the confluent calyx-glands of *M. grammadenia*, which suggested the epithet. — Habit × 1; the rest × 5.

1) branch of panicle; 2) leaflets; 3) flower, in profile; 4) flower, ventral view; 5) banner, ventral and profile views; 6) wing; 7) keel; 8) androecium; 9) fruiting calyx; 10) pod.

XXVII
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MARINA
GRAMMADENIA

PLATE XXVIII

Marina scopa Barneby, a coarse monopodial annual flowering in late fall and winter, colonial in cornfields, disturbed places, pedregal, and along highways over much of temperate and arid tropical Mexico and central America, sparingly adventive in Venezuela and Cuba. The plant is wholly glabrous, with one stout, red, virgate stem often a meter tall or more that loses its frondose foliage in the dry season as it passes upward into an elaborately ramified, fastigiate or amply flat-topped panicle of capillary, few-flowered racemes. Only one flower in each raceme is open at a time. The petals are expanded at dawn and early caducous, falling readily if the stems are shaken and naturally deciduous by noon. The related *M. nutans* (Plate No. XXIII), often confused with *M. scopa*, has many flowers open at once, is perennial, and has a differently shaped banner. Inflorescence and main cauline leaf × 1; the rest × 5.

1) branchlet from panicle; 2) main cauline leaf; 3) flower, in profile; 3a) another flower; 3b) flower, dorsal view; 4) banner, 2 ventral 1 profile view; 5) wing; 6) keel; 7) androecium, expanded and coiled after anthesis; 8) pod.

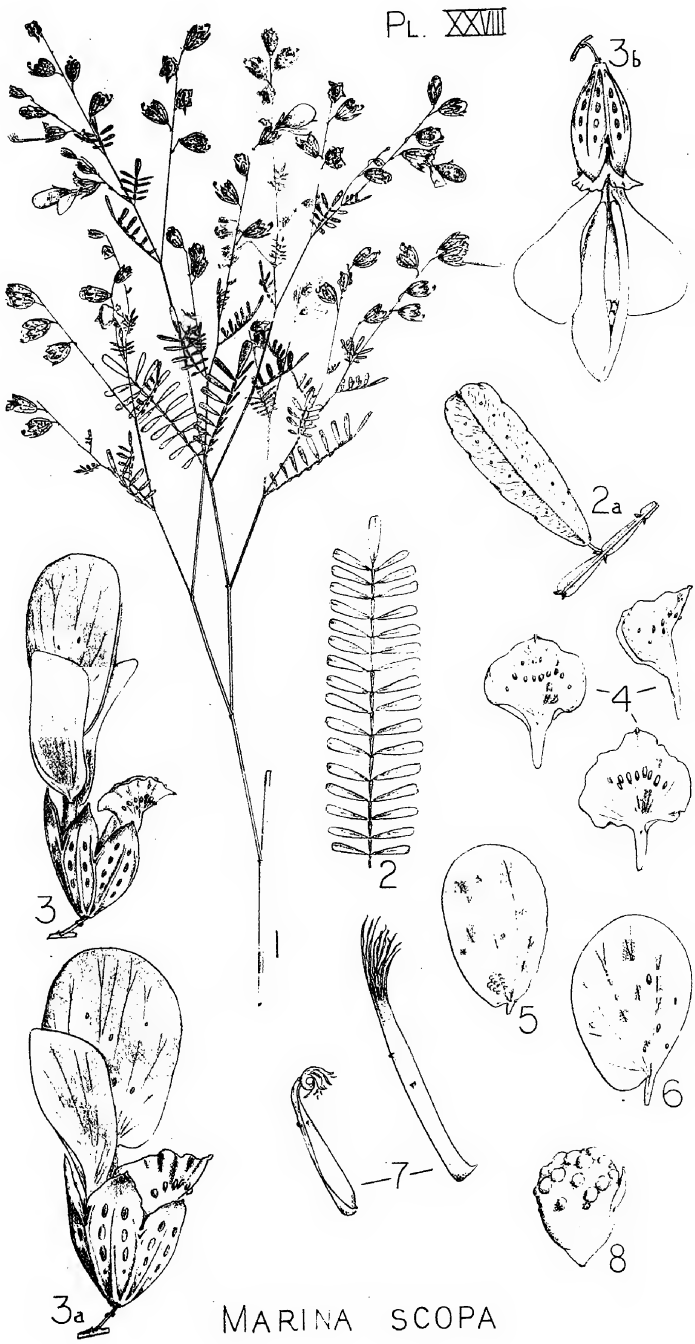

PL. XXVIII
3b
2a
4
2
3
1
5
6
7
8
3a
MARINA SCOPA

PLATE XXIX

Dalea filiciformis Robins. & Greenm. has an unmistakable facies; the combination of many small, round, glabrous and glaucescent leaflets with a lax raceme of pedicelled flowers and a long-toothed, plumose calyx is unique in the genus. The species is widely dispersed over the arid grasslands of the Mexican plateau from southeastern Durango (Nombre de Dios) and the Sierra Madre Oriental in Nuevo León (Galeana) s. to the Valley of Mexico, and interruptedly to the tropical desert valleys of Puebla, adjoining Morelos, and central Oaxaca. Northward from the Neovolcanic Belt the plants are herbaceous or feebly suffruticose, the stems dying back yearly to the crown of a stout taproot. The preferred (but not obligate) habitat is on gypsum or limestone, and the petals open pale rose or lavender, heavily brownish-veined, fading brown or dull purple. Southward the stems often persist from year to year and may form broomlike shrubs up to 2 m tall. Plants of this type flower irregularly from midsummer until well into winter, and occur on a variety of substrata, including limestones, mixed alluvia, volcanic tuffs, and even in crevices of basalt cliffs. In Oaxaca the petals are sometimes soft clear blue, sometimes roseate as commonly northward. — Inflorescence and main cauline leaf × 1; the rest × 5.

1) Inflorescence; 2) main cauline leaf; 3) leaflet, dorsal view; 4) buds, showing the spathaceous bracts, cast off by the swelling flower; 5) flower; 6) banner, ventral and profile views; 7) wing; 8) keel; 9) androecium; 10) pod.

DALEA FILICIFORMIS

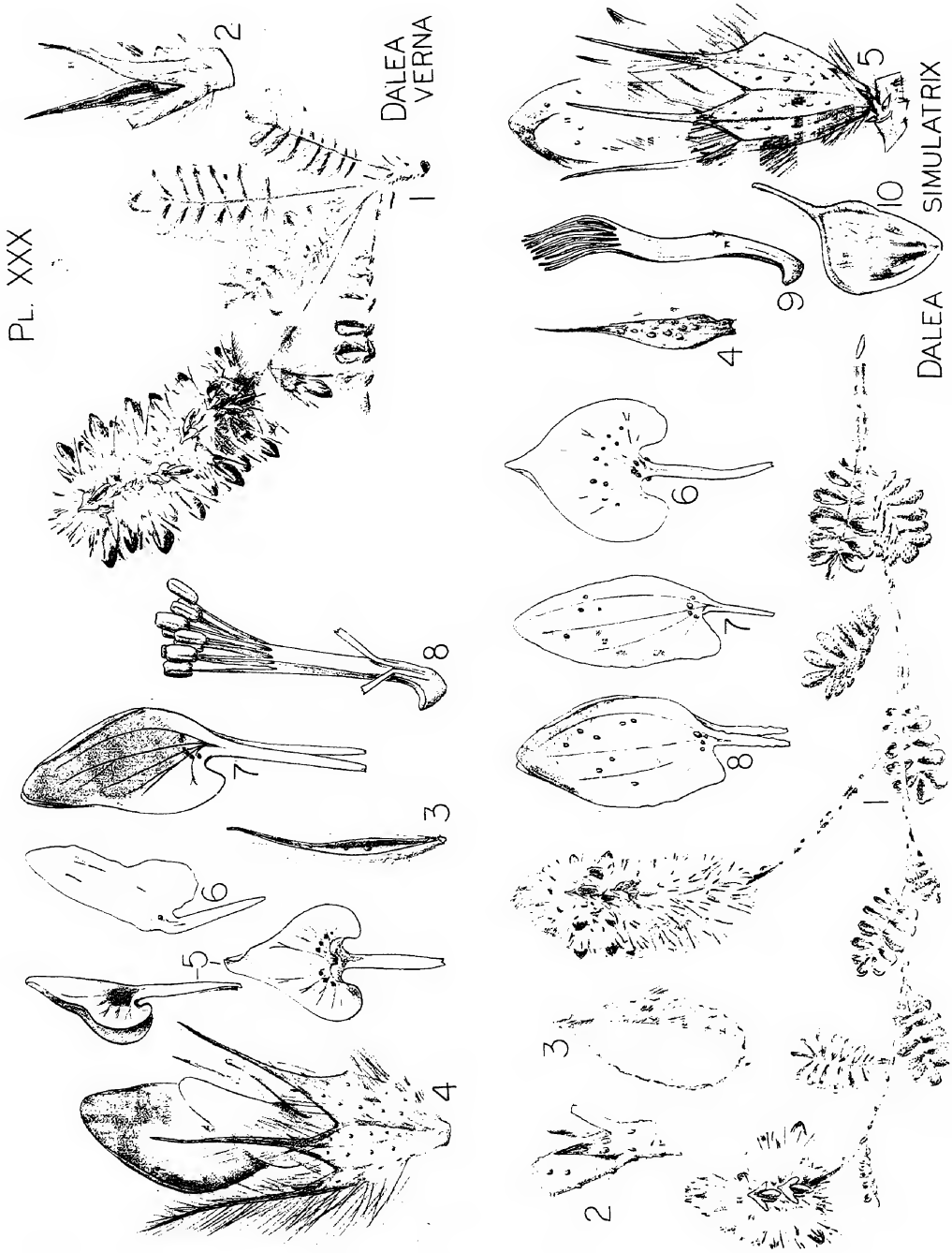
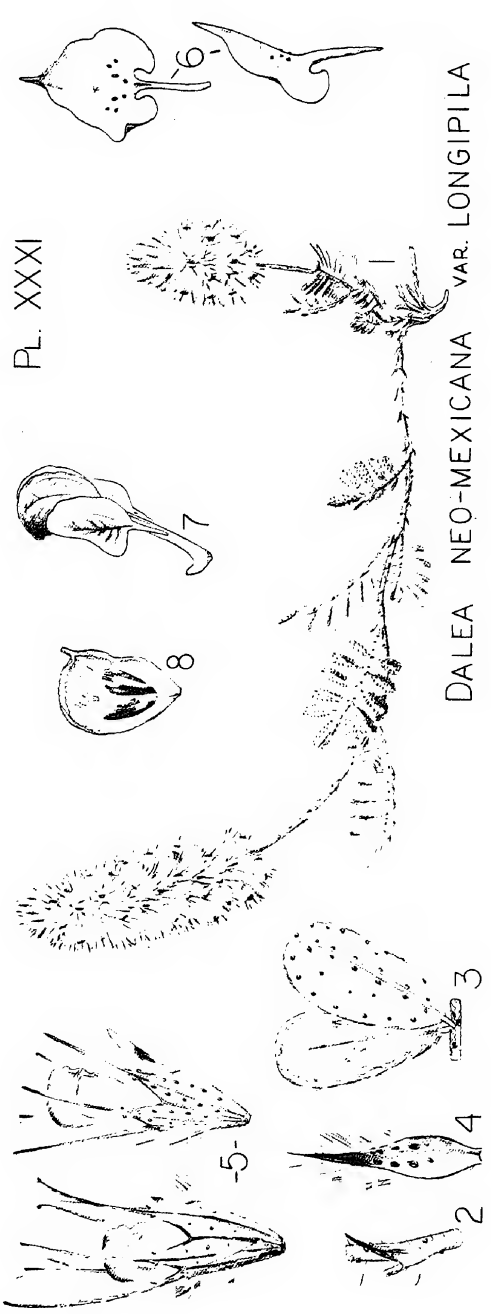

PL. XXX
DALEA VERNA
DALEA SIMULATRIX

PLATE XXX

Dalea verna Barneby and **D. simulatrix** Barneby share a common habitat of breaks and knolls in the arid grasslands along and near the e. piedmont of Sierra Madre Occidental in s.-centr. Chihuahua, n. Durango, and adjoining Zacatecas. The remarkable *D. verna*, which flowers in the dry spring months (April, May) is subacaulescent and loosely cespitose, forming cushions of lustrously silky-pilose foliage. The flower, large for a member of sect. *Theodora*, is bicolored when first open, the banner whitish with a green eye but early rubescent, the marcescent keel dull crimson-purple. The foliage, although aromatic when bruised, is not obviously gland-punctate. The habit of diffuse or humifuse *D. simulatrix* and its main flowering period in the fall months are hardly different from those of the closely related *D. neo-mexicana* (Pl. XXXI, XXXII), from which it differs, however, in the larger flower and deciduous keel. Here the banner opens whitish and fades dull pink, and the inner half of wing and keel blades are pinkish-purple. Habit × 1; the rest × 5.

D. verna: 1) flowering stem; 2) stipules; 3) bract, ventral view; 4) flower; 5) banner, profile and ventral views; 6) wing; 7) keel; 8) androecium, showing keel-claws attached to column.

D. simulatrix: 1) upper half of stem; 2) stipules; 3) leaflet, ventral view; 4) bract, ventral view; 5) flower; 6) banner, ventral view; 7) wing; 8) keel; 9) androecium; 10) pod.


PL. XXXI
DALEA NEO-MEXICANA VAR. LONGIPILA
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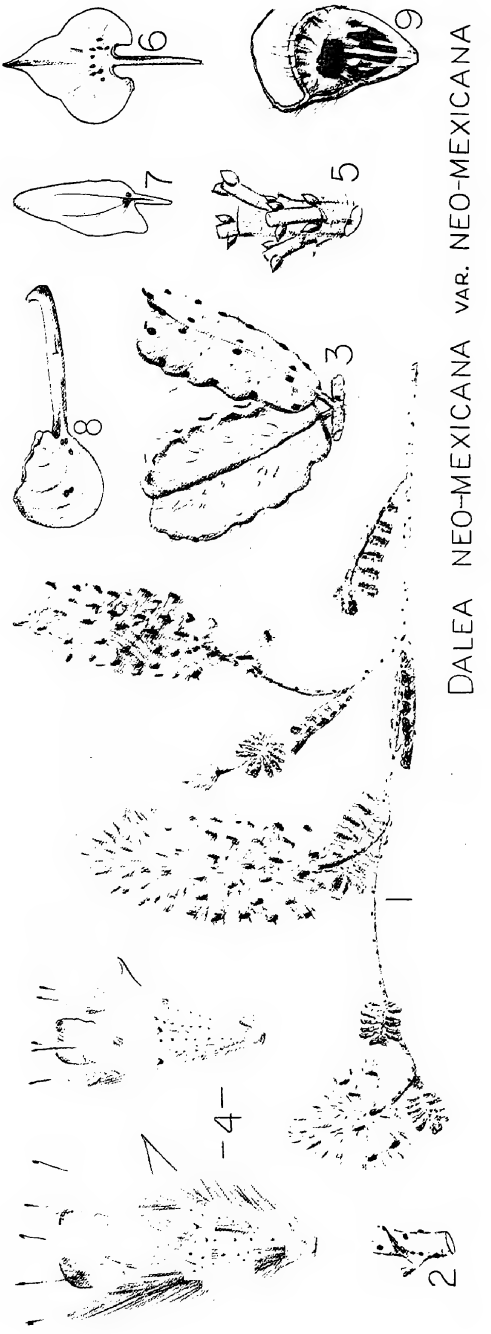
DALEA NEO-MEXICANA VAR. NEO-MEXICANA
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PLATE XXXI

Dalea neo-mexicana Gray, in part: var. **longipila** (B. L. Robins.) Barneby and var. **neo-mexicana**; a third variety, var. **megaladenia** Barneby, is illustrated on Plate XXXII. The two forms shown here are low, tufted or matted, precociously flowering perennial herbs with decumbent stems up to 2 dm long from slender yellow roots, soft gray-villous foliage, and ovoid-oblong heads of lustrously plumose, nodding calyces. The inconspicuous flowers are curiously colored: banner whitish, with gland-sprinkled eye at first greenish fading purple; wings white, sometimes blotched with purple; keel tipped with dull crimson. Note the persistent keel, not jointed to the androecial column in true Dalea fashion, a feature that differentiates *D. neo-mexicana* from its close relatives on the Sonoran Desert (cf. Plate XXXIII). The var. *neo-mexicana*, which ranges from s.-e. Arizona and adjoining Sonora to trans-Pecos Texas, s. into e.-centr. Chihuahua and w. Coahuila, has mostly cuneate-obcordate leaflets undulate around the edges following a row of large, blackish, submarginal glands. The leaflets of var. *longipila*, common over much of Coahuila and extending s. to centr. Tamaulipas and n. across the Rio Grande just east of the Big Bend, are obovate, obtuse or scarcely emarginate at apex with plane margins and smaller glands on the back. The local var. *megaladenia*, found near the common range-limits of the two preceding in Coahuila and adjoining Chihuahua, has leaflets undulate as in var. *neo-mexicana* but green and glabrate above. The glands on the pedicels are extremely large, and the petals often light yellow when fresh but the keel-tip maculate in age. — Stems × 1; pedicels + glands (fig. 5, bottom) × 10; raceme-axis and pod of var. *megaladenia* (Pl. XXXII, figs. 4, 9) × 10; the rest × 5.

var. *longipila*: 1) habit; 2) stipules; 3) leaflets; 4) bract, ventral view; 5) flowers; 6) banner, ventral and profile views; 7) wings and keel attached to androecial column; 8) pod.

var. *neo-mexicana*: 1) flowering stem; 2) stipules; 3) leaflets; 4) flowers; 5) pedicels + glands; 6) banner, ventral view; 7) wing; 8) keel + androecium; 9) pod.

var. *megaladenia*: 1) top of flowering stem; 2) leaflet, ventral view; 3) bract, ventral view; 4) segment of raceme axis, showing pedicels + glands; 5) flowers; 6) banner, ventral and profile views; 7) wing; 8) androecium + keel; 9) pod, seen from above and in profile.

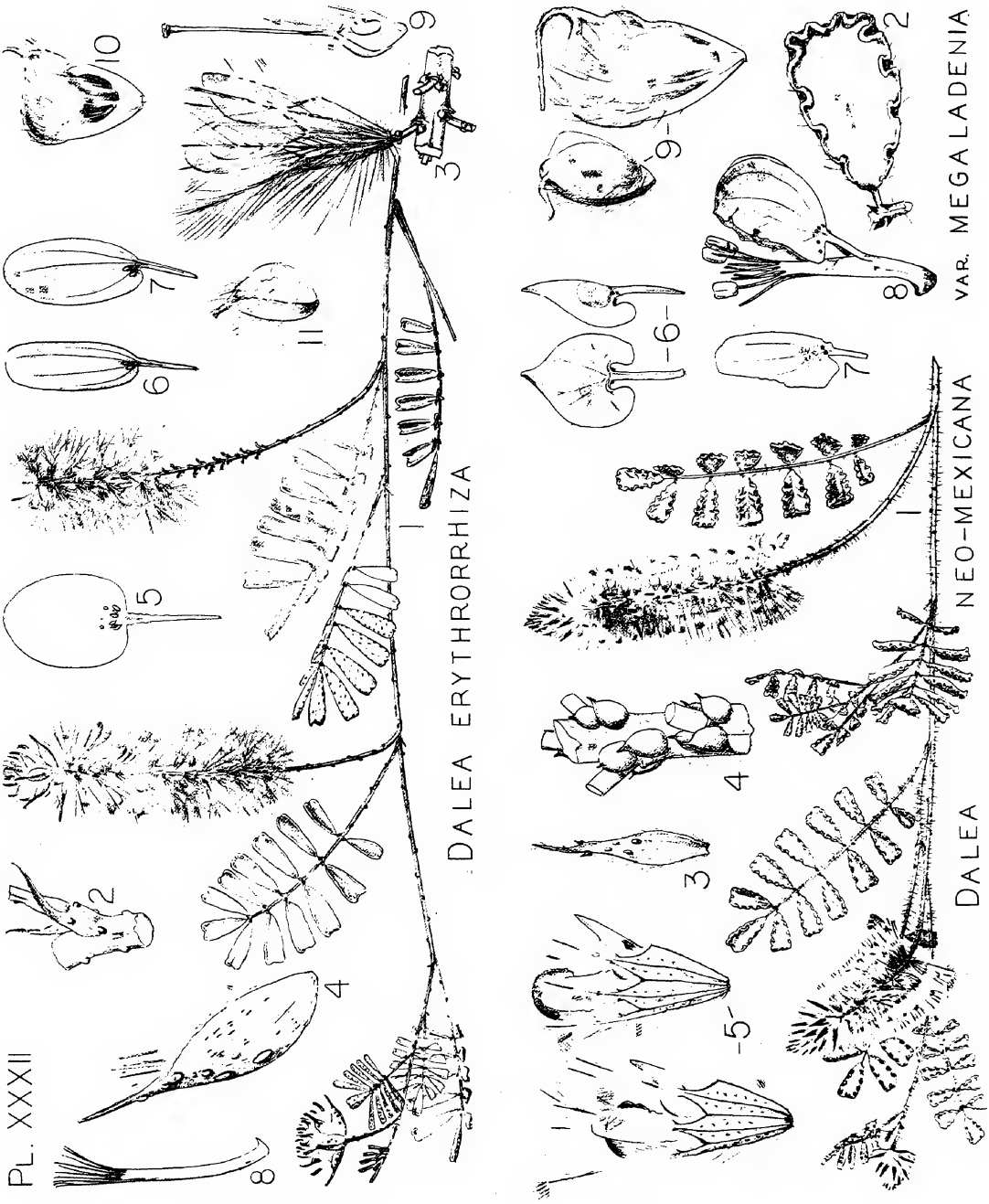
PL. XXXII
DALEA ERYTHRORRHIZA
DALEA NEO-MEXICANA
VAR. MEGALADENIA

PLATE XXXII

Dalea neo-mexicana Gray var. **megaladenia**, part of a species further illustrated in Plate XXXI (q. v. for caption) and **D. erythrorrhiza** Greenman. The latter is a humifuse perennial herb endemic to the arid grasslands of Mexico's Meseta Central, between s.-centr. Chihuahua, n. San Luis Potosí, and Aguas Calientes, where it flowers from June to November. The flexuous dark purple stems, glaucescent foliage glabrous except for a few long hairs along the leaf-stalks, the proportionately large racemes of nodding, lustrously hispid calyces, and vivid blue petals form a combination unique in the genus. The only close relative, *D. lachnostachya* (Pl. XXXIV), is like it in the curious flasklike bracts and blue petals all charged at top of the claw with a cluster of small yellow glands, but easily distinguished by its roughly black-warty, erect stems and pilosulous leaflets. — Habit × 1; the rest × 5.

D. neo-mexicana var. *megaladenia*: cf. under Pl. XXXI.

D. erythrorrhiza: 1) top of flowering stem; 2) stipules; 3) flower + segment of raceme-axis; 4) bract + emerging flower-bud; 5) banner, ventral view; 6) wing; 7) keel-petal; 8) androecium; 9) gynoecium; 10) pod, profile view; 11) do., looking down on the dilated prow.

PL. XXXIII
DALEA MOLLISSIMA
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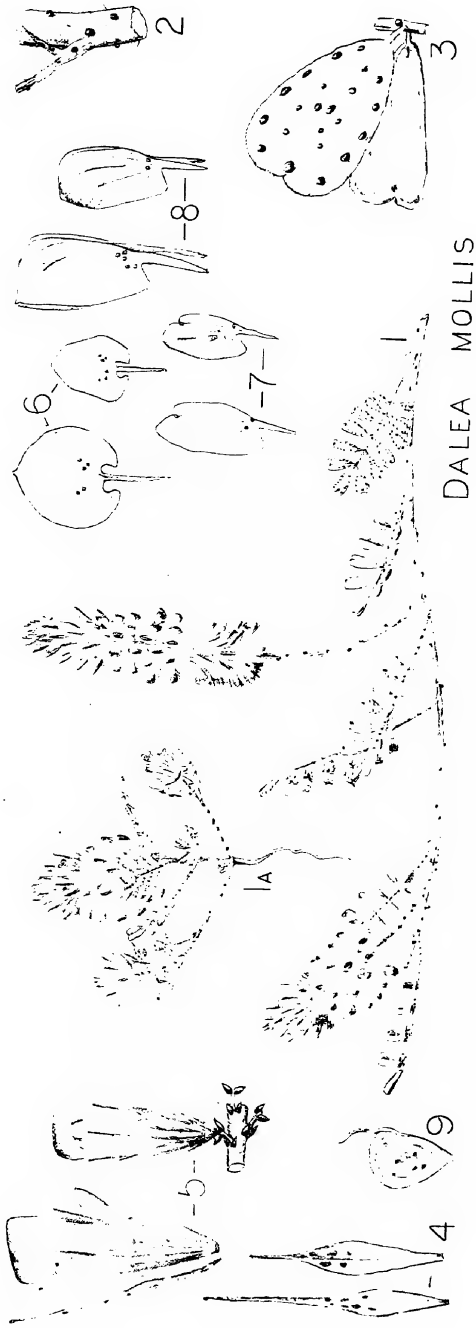
DALEA MOLLIS
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PLATE XXXIII

Dalea mollissima (Rydberg) Munz and **D. mollis** Bentham, loosely tufted or procumbent annual herbs widely dispersed over the floor and low foothills of the Sonoran Desert, flowering in late winter and spring. Both have pallid-glaucescent but more or less pilose foliage and ovoid racemes of early nodding, silvery-pilose calyces which almost or quite enclose the whitish or dull crimson petals. Collectively the species differ from closely allied *D. neo-mexicana* in their annual taproots and readily disjointing keel-petals. The relatively northern *D. mollissima*, common over the Colorado Desert in California, extends weakly into n. Baja California, the Gila Desert in Arizona, and through s.-e. Mohave Desert into the s. angle of Nevada. It has relatively long calyx-teeth, broad interfloral bracts, and leaflets undulate around the margin. The calyx-teeth of *D. mollis* being shorter relative to the slightly exserted keel form narrower spikes, the flowers are separated in bud by narrower bracts, and the margins of the leaflets are plane. The main range of *D. mollis* lies around the Gulf of California from the latitude of La Paz in Baja California and that of Guaymas in Sonora northward, but it reaches the Pacific Coast on Islas Magdalena and Cedros and extends well into that of *D. mollissima*, as far north as Salton Depression and the s. edge of Mohave Desert in California and the Colorado valley in s.-w. Arizona. — Habit × 1; the rest × 5.

D. mollissima: 1) top of flowering stem; 2) leaflets; 3) interfloral bract, dorsal and ventral views; 4) flower + pedicels; 5) calyx, laid open; 6) banner, ventral and profile views; 7) wing; 8) keel; 9) androecium; 10) pod.

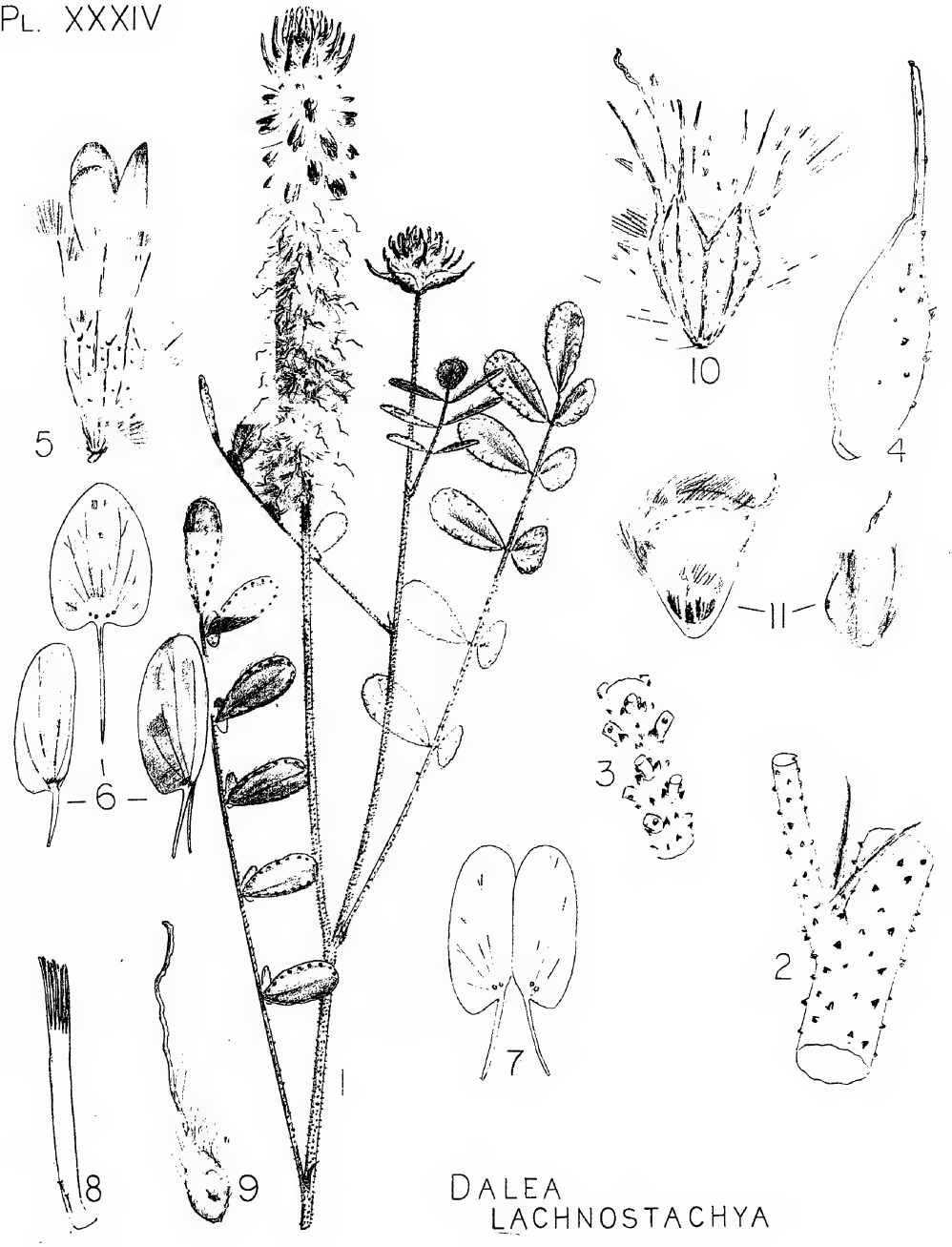
D. mollis: 1) top of flowering stem; 1a) depauperate plant; 2) stipules; 3) leaflets; 4) interfloral bracts, ventral view; 5) flowers; 6) banners, small and large; 7) wings, do. 8) keels, do. 9) pod.

PLATE XXXIV

Dalea lachnostachya Gray, an erect herb up to 4 dm tall with densely back-warty stems, few but large leaflets pilosulous both sides and dense racemes of finally nodding, hispidly long-pilose calyces. The petals, proportionately small, little exserted and quickly shed, are vivid blue. Note the membranous, flask-shaped bracts that form a loose cone at top of the expanding inflorescence, the relatively long banner, the overlapping keel-petals, the dilated style-tip, and the greatly thickened prow of the pod, characters shared by the diffuse *D. erythrorrhiza* (Pl. XXXII) but by no other dalea. A species of arid grassland transitional to desert, *D. lachnostachya* is dispersed widely over the Chihuahuan Desert, from s.-centr. Chihuahua to extreme n.-w. Coahuila, trans-Pecos Texas, and s.-w. New Mexico, thence extending w. to the margins of the Gila Basin in Arizona and adjoining Sonora, and flowers mostly after summer rains, between July and October. — Stem × 1; the rest × 5.

1) top half of robust flowering stem; 2) segment of mid-stem + stipules and base of petiole; 3) segment of raceme-axis, showing pedicels & glands; 4) interfloral bract, profile; 5) flower; 6) petals, the banner in ventral view; 7) keel, opened up; 8) androecium; 9) ovary & style; 10) fruiting calyx; 11) pod, profile and seen from above.

PL. XXXIV

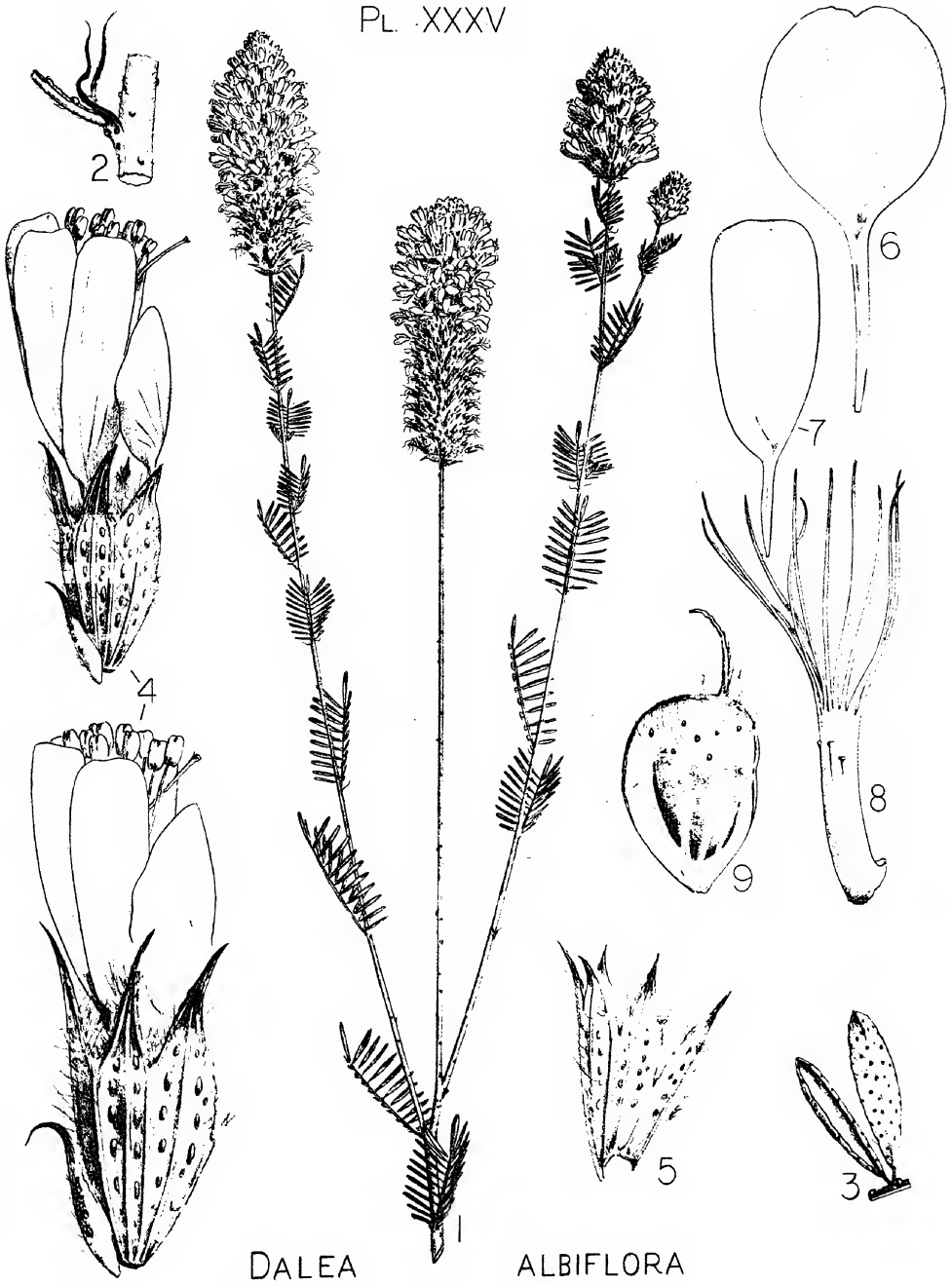


DALEA
LACHNOSTACHYA

PLATE XXXV

Dalea albiflora Gray, a diffuse or assurgent herb about 3–6 dm tall, finely pilosulous throughout, bearing in the fall months and sometimes again in spring many dense, cylindric, tassel-like spikes of small, pure white flowers. The plants vary in length and density of pubescence, and independently in diameter of the spikes, those shown here being of about medium length and thickness. The species is common in grassland and in open oak-pine woodland between 1050 and 2250 m in the Sierra Madre of Chihuahua and adjoining Durango, and in the floristically related mountain ranges about the headwaters of the Gila River in southwestern New Mexico, southeastern Arizona, and neighboring Sonora. Note the free inner petals that resemble those of the white prairie-clover, *D. candida*, the slightly exserted stamens, and the deeply cleft androecium likewise recalling that of sect. *Kuhnistera* except that there are here ten filaments. Inflorescence × 1; stipules and leaflets × 5; the rest × 10.

1) summit of flowering stem; 2) stipules; 3) leaflets; 4) larger and smaller flowers; 5) calyx, laid open; 6) banner, ventral view; 7) keel-petal; 8) androecium; 9) pod.


PL. XXXV
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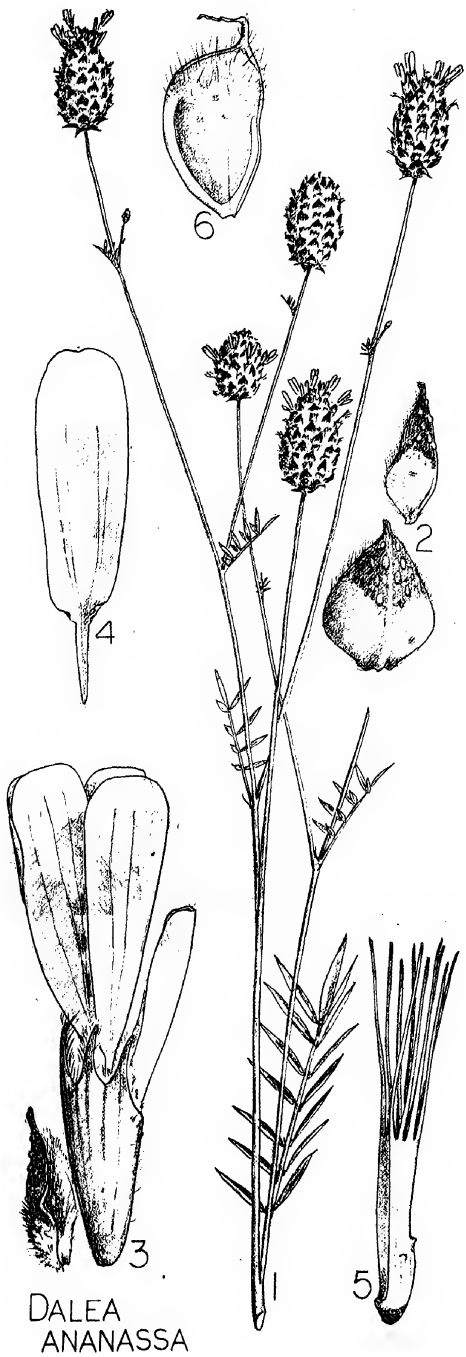
DALEA ALBIFLORA

PLATE XXXVI

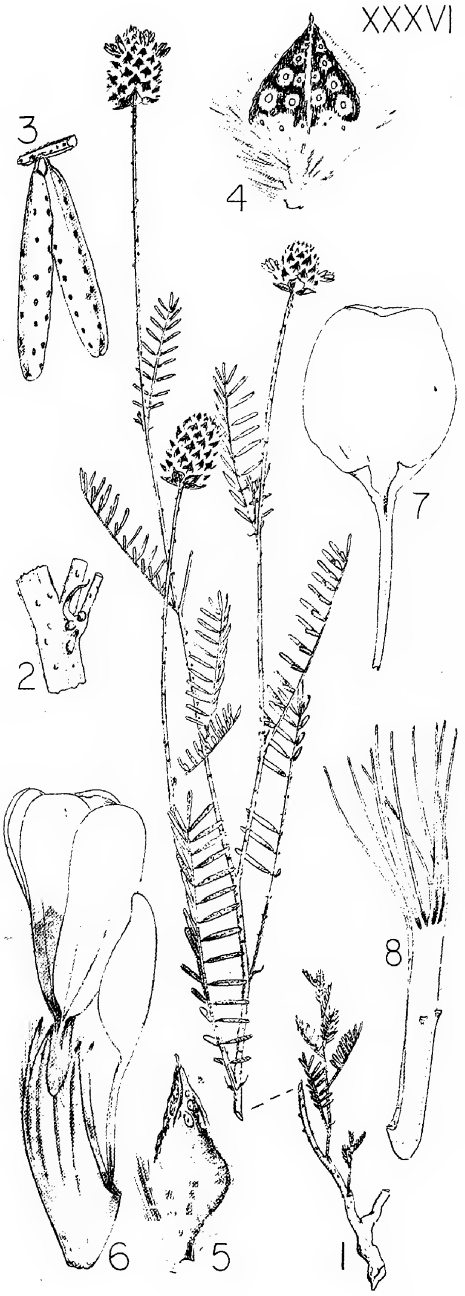
Dalea ananassa Barneby and **D. lumholtzii** Robinson & Fernald, uncommon fall-flowering herbs of the oak-belt on the Pacific slope of Sierra Madre Occidental, from centr. Sinaloa n. through Sonora and adjoining Chihuahua into s. Arizona. Notable features of both are the hard, conelike knobs of densely packed bracts and calyces, the narrow, externally glabrescent, glandless calyx-tubes, and deeply cleft tassel of filaments. The petals may be either white or the epistemonous ones tinged with blue. Stems and foliage of *D. ananassa*, local in s. Sonora and Sinaloa, are completely glabrous, the leaflets are relatively few, the interfloral bracts are densely silky inside, and the calyx-tube is only a trifle recessed behind the banner. Stems and foliage of *D. lumholtzii*, dispersed n.-ward from upper Río Mayo in Sonora to Arizona, are at least thinly puberulent and sometimes densely pilosulous, the leaflets are relatively many, the interfloral bracts hairless within, and the calyx-tube notably asymmetrical at orifice. — Habit × 1; the rest × 5.

D. ananassa: 1) top of flowering stem; 2) interfloral bract, profile and dorsal views; 3) flower + bract; 4) banner, ventral view; 5) androecium; 6) pod.

Dalea lumholtzii: 1) base and top of flowering stem; 2) stipules; 3) leaflets; 4) interfloral bract, dorsal view; 5) do., semi-ventral view; 6) flower; 7) banner, ventral view; 8) androecium.



DALEA ANANASSA



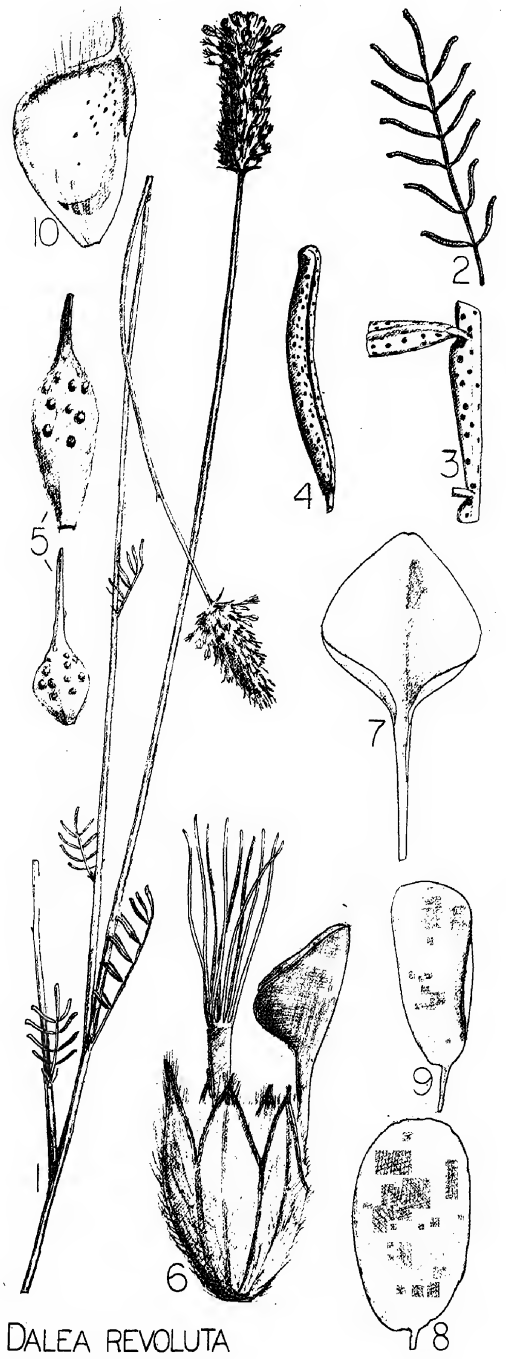
DALEA LUMHOLTZII

PLATE XXXVII

Dalea revoluta Wats. and **D. grayi** (Vail) L. O. Wms. are herbs of western Mexico northward from Jalisco, just reaching southwestern United States. Both are glabrous below the spikes of small fugitive, vexillate flowers; the sharply ribbed stems may be erect or trailing, monocephalous or branched distally, and the petals, except for the rubescent banner, are all white. The range of *D. revoluta*, which has about 3–9 pairs of (despite the epithet) involute, not revolute leaflets and a glandless calyx, runs along the Pacific slope of Sierra Madre Occidental, mostly in the foothills below 1300 m, from southern Sonora south into Jalisco, where it follows the Río Santiago inland to Guadalajara and the Bolaños valley. The closely related *D. grayi*, with many leaflets and small glands in the intervals of the calyx-tube, is found only in the northern Sierra Madre, mostly on the plateau slope, from northern Durango into southeastern Arizona and adjoining New Mexico. Both species flower in summer, fall, and winter, depending on the elevation and the season. Inflorescences × 1; the rest, unless otherwise noted, × 10.

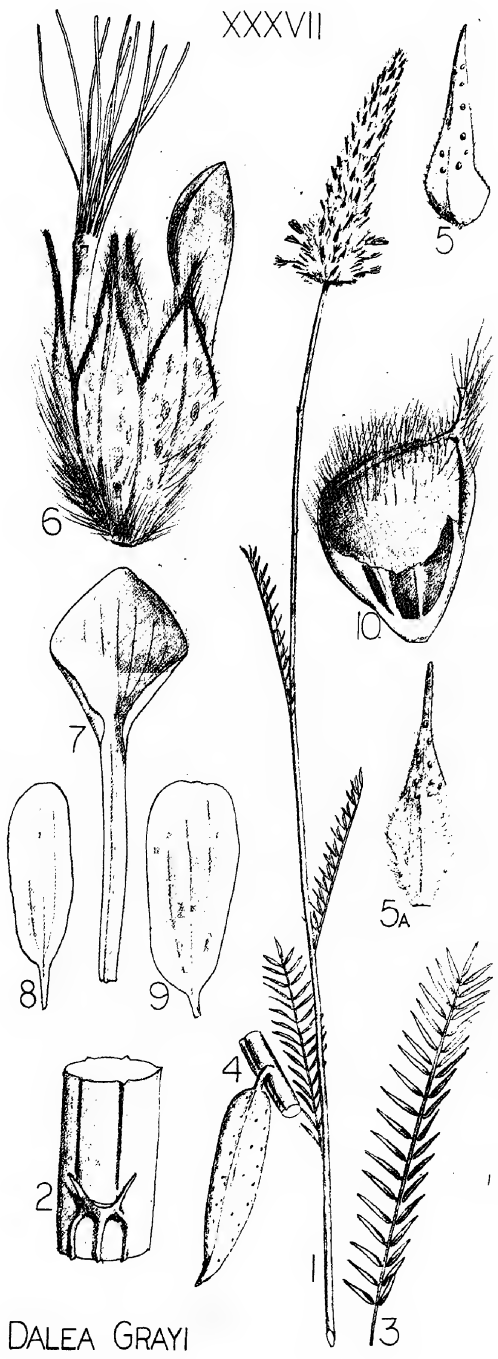
D. revoluta: 1) upper part of stem; 2) main cauline leaf × 2; 3) part of leaf-rachis; 4) leaflet, ventral view; 5) bracts; 6) flower at late anthesis; 7) banner; 8) wing; 9) one keel-petal; 10) pod.

D. grayi: 1) upper part of stem; 2) stipules; 3) main cauline leaf × 1; 4) leaflet, dorsal view; 5, 5a) bracts, lower and upper, dorsal view; 6) flower at late anthesis; 7) banner; 8) wing; 9) one keel-petal; 10) pod.



DALEA REVOLUTA

XXXVII



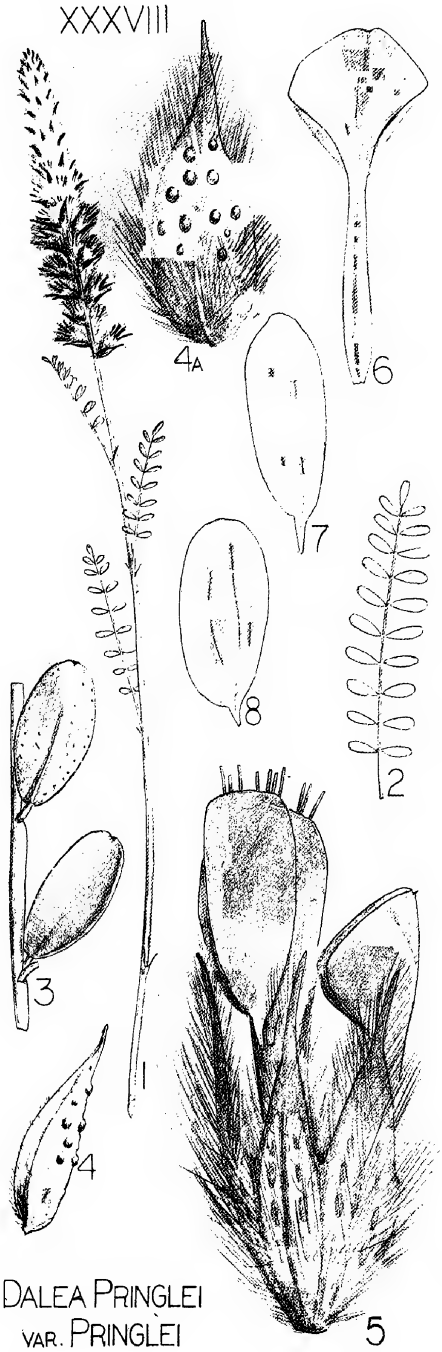
DALEA GRAYI

PLATE XXXVIII

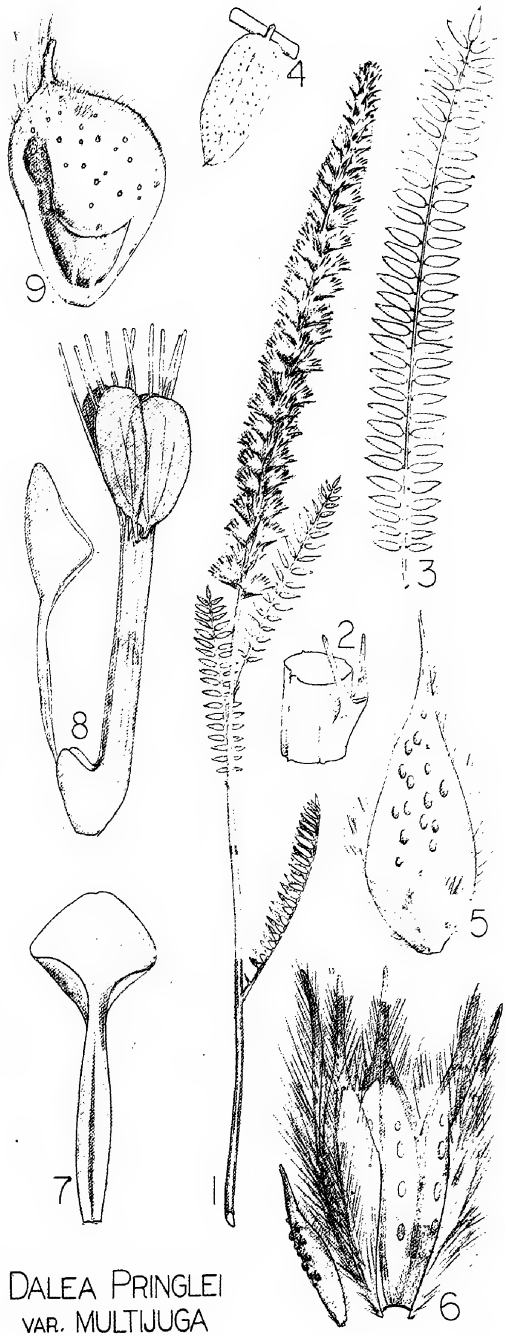
Dalea pringlei Gray (see continuation, Plate XXXIX), a polymorphic species of the w. slope and piedmont of Sierra Madre Occidental, ranging from n. Sinaloa through Sonora into the watershed of the Gila River in s.-e. Arizona. The three varieties differ in stature, number and shape of leaflets, and length of calyx-teeth, but all are glabrous up to the softly plumose spikes, have strongly angled, green or pruinose-glaucescent stems, and (except in some populations of var. *multijuga*) vivid magenta-purple inner petals. The var. **pringlei**, common in Arizona and extending into extreme n. Sonora, flowers principally in spring. The stems seldom surpass 6 dm in height, the obtuse leaflets are relatively few, the bracts are mostly pubescent from base to tip, and the calyx-teeth are longer than the tube. The more southern, entirely Mexican var. **multijuga** Barneby and var. **oxyphyllidia** Barneby are both taller, virgate plants reaching 1–2.5 m at maturity, and flower during late fall and winter; they are alike, further, in having acute leaflets and bracts mostly glabrate toward the tip. The relatively common var. *multijuga* is distinguished by its very numerous leaflets, long, relatively loose spikes, and long-toothed calyx; var. *oxyphyllidia*, very local in the valley of Río Mayo, s. Sonora, where its range overlaps that of var. *multijuga*, by its few leaflets, compact spike, and short-toothed calyx. — Habit and cauline leaves × 1; bracts, flowers, androecia, and pod in this plate × 10; leaflets and all enlargements of var. *oxyphyllidia* (Plate XXXIX) × 5.

var. *pringlei*: 1) flowering branchlet; 2) cauline leaf; 3) part of leaf-rachis + leaflets; 4) lowermost bract, dorsal view; 4a) upper bract, dorsal view; 5) flower; 6) banner, ventral view; 7) wing; 8) keel-petal.

var. *multijuga*: 1) flowering branchlet; 2) stipules; 3) cauline leaf; 4) leaflet, dorsal view; 5) bract, dorsal view; 6) bract + calyx, laid open; 7) banner, ventral view; 8) flower, calyx + anthers removed; 9) pod.



DALEA PRINGLEI
VAR. PRINGLEI



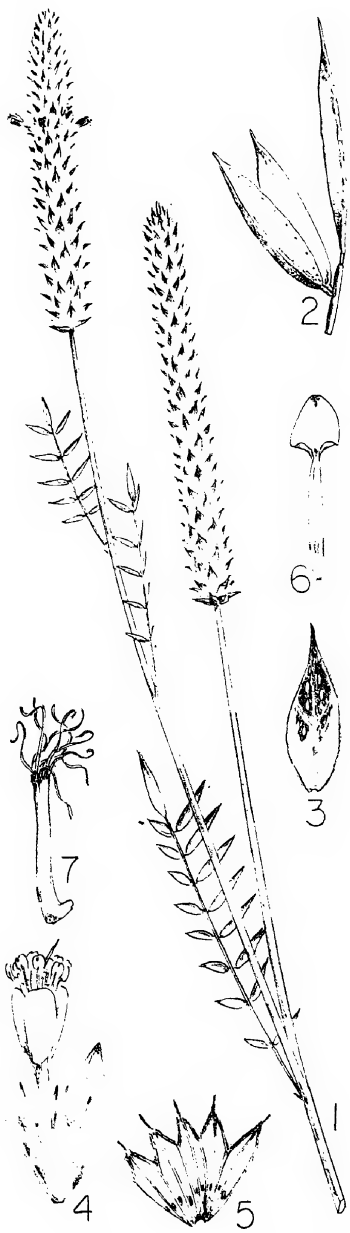
DALEA PRINGLEI
VAR. MULTIJUGA

PLATE XXXIX

Dalea pringlei Gray var. **oxyphyllidia** Barneby (for full caption see Plate XXXVIII) and **D. nelsonii** (Rydb.) Barneby. Endemic to pine-oak forest at 1800–2460 m near the crest of Sierra Madre Occidental in s.-w. Chihuahua and central Durango, *D. nelsonii* is a diffuse, many-stemmed perennial herb, glabrous except for sometimes puberulent bracts and thinly hairy orifice to the calyx. The stems are conspicuously warty, the foliage green, the petals bicolored, the white (but rubescent) banner contrasting with bright lavender-blue wings and keel. Note the narrowly caudate stipules, the oblique, lustrously hyaline, multiglandular calyx, and the small inner petals, which are caducous, all free in aestivation, and at full anthesis perched high on the androecial column, at or beyond the level of the tips of the shorter calyx-teeth. — Habit × 1; the rest × 5.

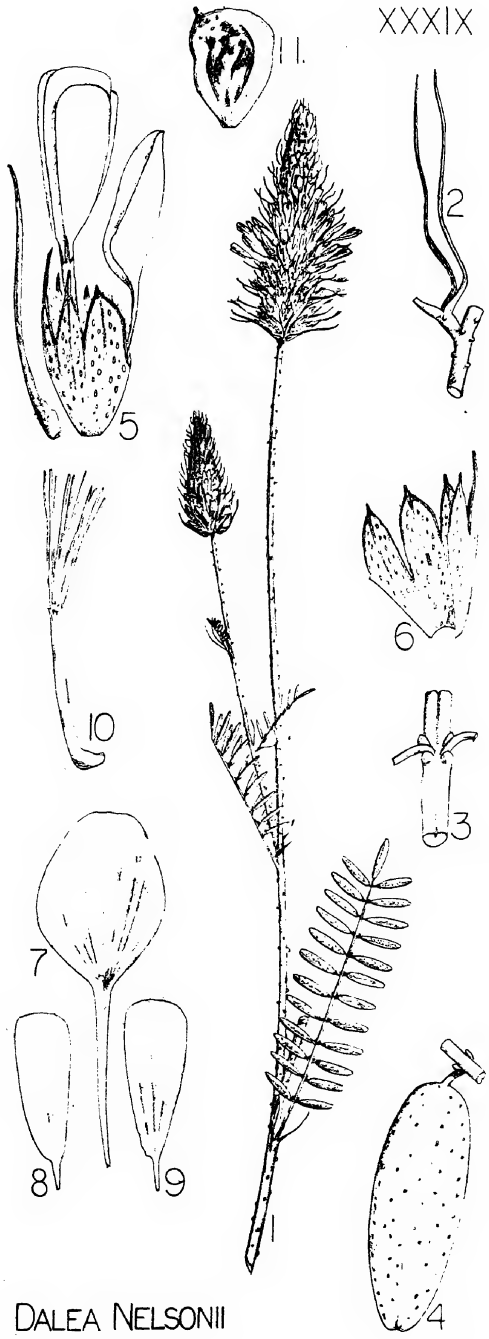
D. pringlei var. *oxyphyllidia*: 1) top of flowering stem; 2) three terminal leaflets; 3) bract, ventral view; 4) flower; 5) calyx, laid open; 6) banner, ventral view; 7) androecium after anthesis.

D. nelsonii: 1) top of flowering stem; 2) stipules; 3) part of leaf-rachis + petiolules and associated glands; 4) leaflet, dorsal view; 5) flower + bract; 6) calyx, laid open; 7) banner, ventral view; 8) wing; 9) keel-petal; 10) androecium; 11) pod.

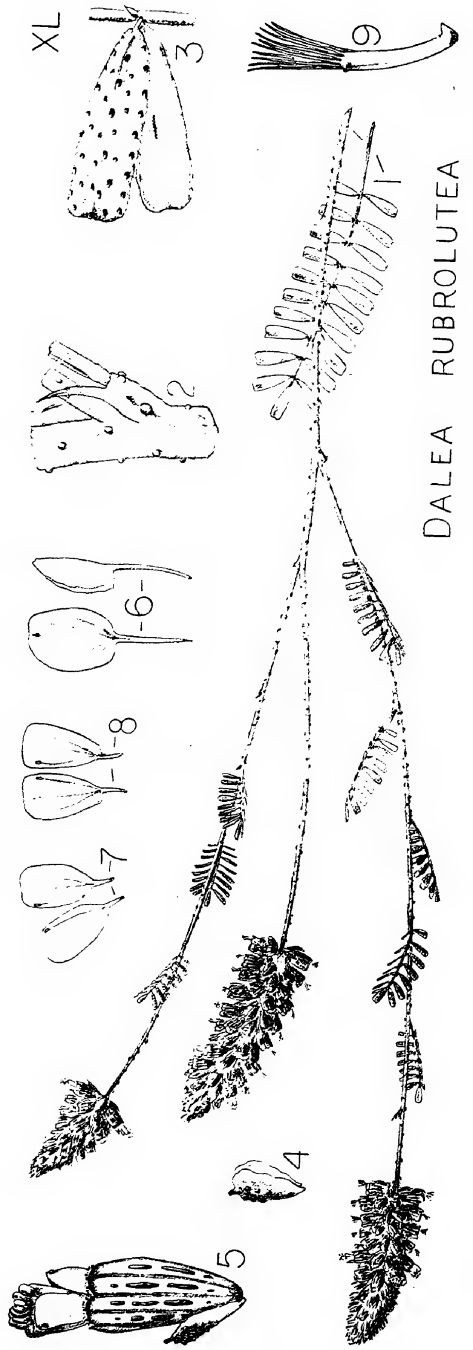


DALEA PRINGLEI
VAR. OXYPHYLLIDIA

XXXIX



DALEA NELSONII


XL
DALEA RUBROLUTEA

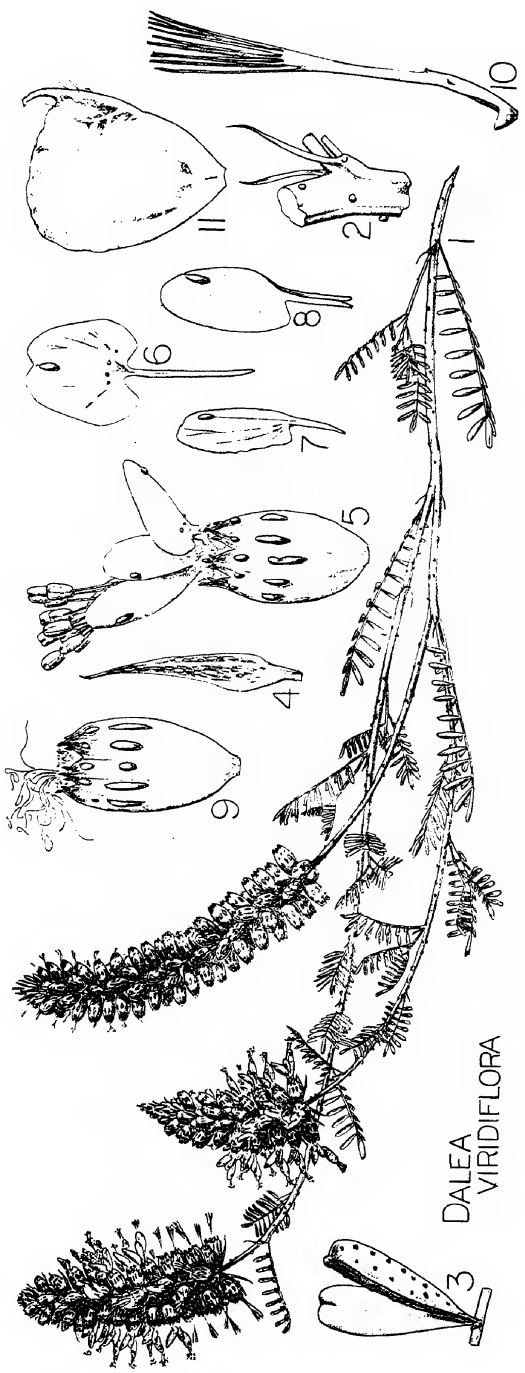

DALEA
VIRIDIFLORA

PLATE XL

Dalea rubrolutea Barneby and **D. viridiflora** Wats. are alike in their warted stems, their lustrously hyaline, flask-shaped calyces charged with orange or livid blister-glands, their yellow, gland-tipped petals, and exserted anthers. The rare *D. rubrolutea*, known only from the canyon of Río Tomellín in n.-e. Oaxaca, flowers in November—December; its ecology and full stature (apparently diffuse) are unknown. The stems are reddish, and puberulent like the foliage; the tiny inner petals, all free even in aestivation, are perched high on the androecial column close to the point of separation of the filaments. The flexuously humifuse *D. viridiflora*, glabrous except for the ciliolate orifice of the calyx, is found in grama grassland at 1680–2430 m along the e. piedmont of Sierra Madre Occidental between central Chihuahua and n. Zacatecas, where its circular mats of foliage are decked with bright yellowish-green tassel-like spikes from September into November. The inner petals are perched only shortly above the hypanthium rim, and the interior pair is united by the outer edges into a regular keel. — Inflorescences × 1; pod × 10; the rest × 5.

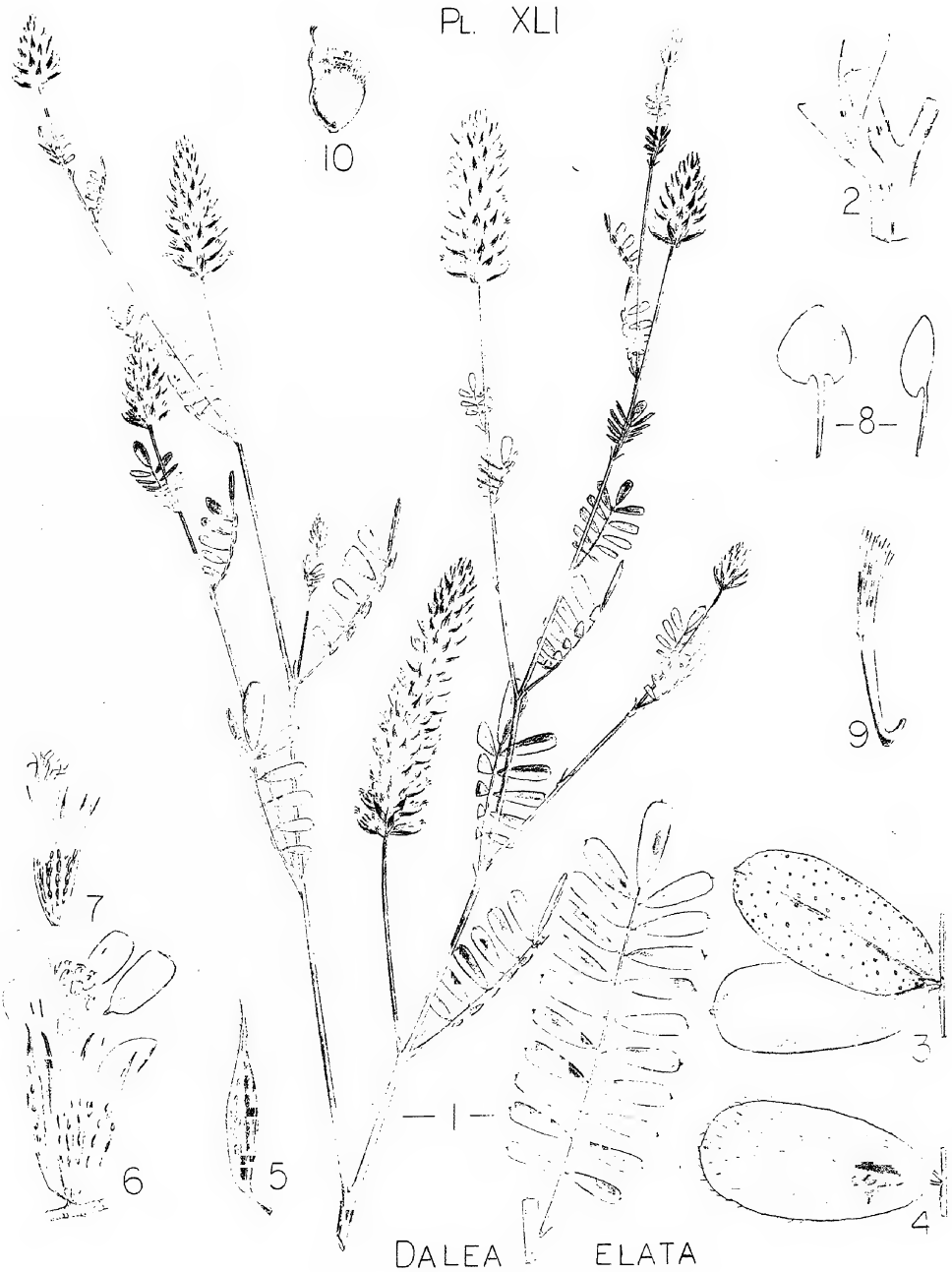
D. rubrolutea: 1) top of flowering stem + main cauline leaf; 2) stipules; 3) leaflets; 4) outermost bract; 5) flower + inner bract; 6) banner, ventral and profile views; 7) wings; 8) keel-petals; 9) androecium.

D. viridiflora: 1) top of stem; 2) stipules; 3) leaflets; 4) bract, dorsal view; 5) flower; 6) banner, ventral view; 7) wing; 8) keel; 9) fruiting calyx; 10) androecium; 11) pod.

PLATE XLI

Dalea elata H. & A., a polymorphic Mexican species dispersed in thorn-forest, grassland, and open oak forest, mostly below 1000 m, along the piedmont of the Sierra Madre from southern Sonora to Jalisco, thence through the valleys of Río Grande de Santiago and Río Balsas to Morelos, and along Sierra Madre del Sur to Guerrero, with outlying stations in Chiapas and on the Gulf slope in Veracruz. The plants can flower preciously when only 1–4 dm tall, and then bear only juvenile foliage, with about 3–7 pairs of leaflets to the leaf. In favorable sites they become perennial, eventually suffruticose or even genuinely shrubby and up to two or even three meters tall, the main cauline leaves then composed of up to twelve pairs of leaflets giving way, however, in the ample but irregular panicle, to leaves of a shorter, simpler type. The foliage varies from almost glabrous to softly pilosulous, and the calyx-tube may be densely pilose throughout, pilose only at base, or glabrous and lustrous. The inconspicuous whitish flowers, produced in flexuous, catkin-like spikes mostly during the dry winter season, but sometimes also in spring or summer, are of fleeting duration, the small inner petals disjointing from the column as this expands in full anthesis. — Habit × 1; the rest × 5.

1) branch of panicle + one main cauline leaf; 2) stipules; 3) glabrous leaflets; 4) pilosulous leaflet; 5) bract, ventral view; 6) flower, showing the inner petals detached; 7) glabrate calyx; 8) banner, ventral and profile views; 9) androecium; 10) pod.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DALEA ELATA

PLATE XLII

Dalea cliffortiana Willd., the original *Dalea* of Linnaeus, is a common, locally abundant, weedy, fall- and winter-flowering annual herb of fields, roadsides, and arid grasslands, ranging from sea-level up into the oak-belt at ± 1800 m (6000 ft) almost throughout the arid tropical lowlands of Mexico and central America, s.-ward on the Pacific coast from Sinaloa and from Vera Cruz on the Gulf. It occurs also, fully established but doubtfully native, in n. Venezuela and coastal Ecuador, and has been naturalized since early XIX century in the Philippine Islands. The stiffly wiry, sharp-angled stems, the few leaflets, and the dense, conelike spikes of persistent, pale-margined, dorsally glandular bracts are characteristic. Note the long-clawed banner, which opens white but fades pinkish, and the small caducous inner petals, perched high on the androecial column and all free even in the bud, which are commonly vivid blue but sometimes violet- or pinkish-purple. The species varies much in size of the bracts and calyces, in thickness of the spikes, and in the number of stamens, which may be either nine or ten. Being autogamous, the plants reduplicate themselves in pure lines and two or more forms showing various combinations of the variable characters can and do occur in close proximity without intergrading. — Habit × 1; leaflets and stipules × 5; the rest × 10.

Left, a common form of *D. cliffortiana* with lance-acuminate bracts in several ranks combined with a 9-merous androecium: 1) habit; 2) stipules; 3) inner bract, dorsal view; 4) fruiting calyx; 5) banner, ventral view; 6) wing; 7) keel, ventro-lateral view; 8) androecium; 9) pod.

Right, a slender form of the same with few-ranked, obovate and abruptly acuminate bracts and a 10-merous androecium: 1) habit; 2) leaflets; 3) inner bract, dorsal view; 4) outer bract + flower; 5) flower, ventral view; 6) androecium.

DALEA CLIFFORTIANA

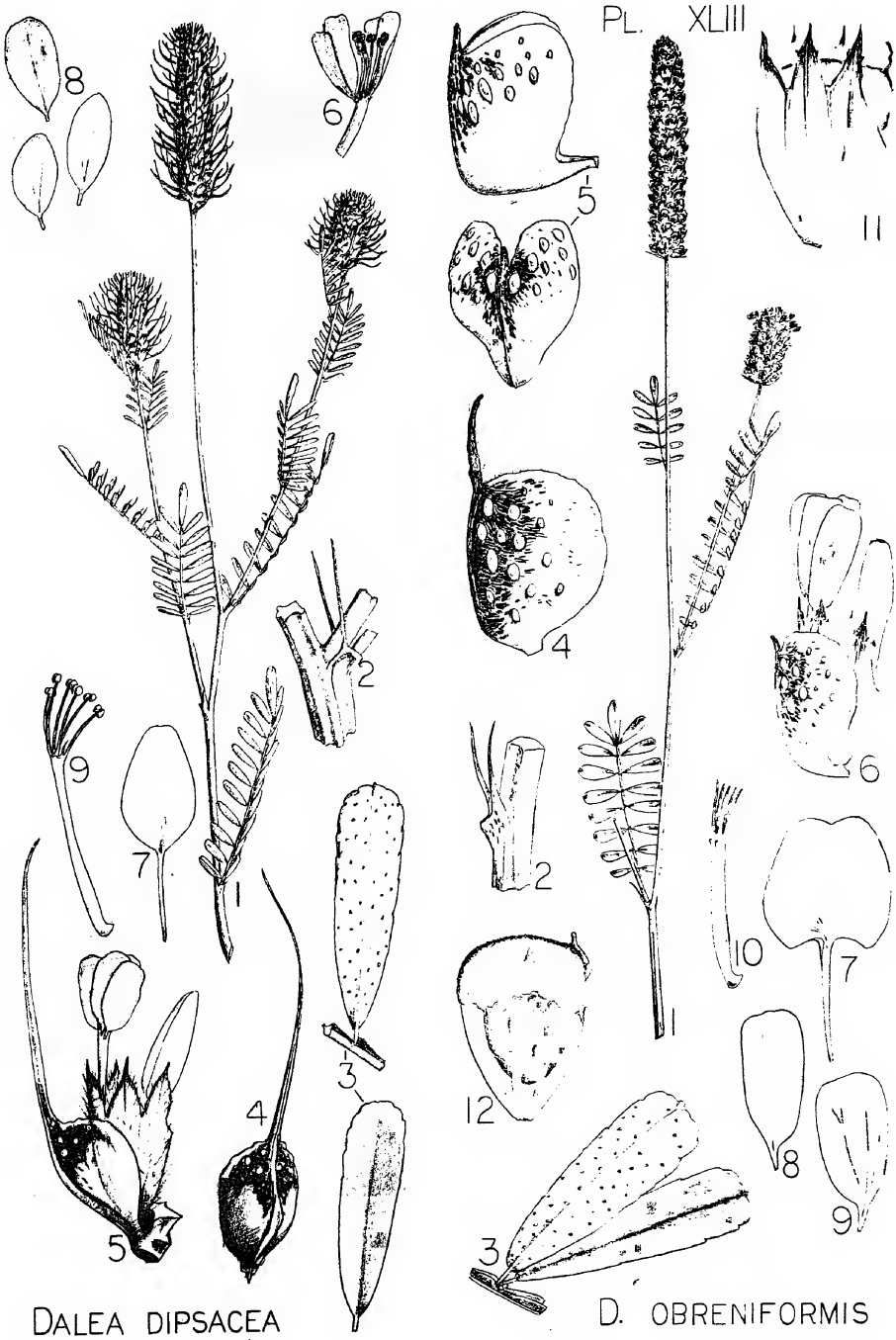
PLATE XLIII

Dalea dipsacea Barneby and **D. obreniformis** (Rydb.) Barneby are annual, Mexican, glabrous or nearly so below the spikes; both have stiff, ribbed stems about 1.5–6 dm tall, green foliage paler beneath, and dense spikes of tiny, fugacious flowers. Other common characters are free keel-petals perched close up to the point of separation of the filaments, an androecium reduced to 7, 6, or 5 members, and anthers exposed although not exserted at anthesis. The flower of *D. dipsacea* is bicolored, the white banner contrasting with violet-blue wings and keel; that of *D. obreniformis* is all vivid blue. Both species are found in the Neovolcanic Belt, mostly in oak-pine woodland, flowering in late summer and fall. The rare *D. dipsacea* is apparently endemic there, but is known from only two stations, one in central Michoacán, one in Nayarit. The range of *D. obreniformis* is bicentric. It is common in the sector of the Neovolcanic Belt lying between Sierra Tepoztlán, Morelos, and Volcán Tancítaro, Michoacán; and reappears in the distant Sierra Madre Occidental in southwestern Chihuahua. Note the long-tailed bracts of *D. dipsacea* and the obcordate ones of *D. obreniformis*; each provides a striking diagnostic feature. Inflorescences × 1; stipules and leaflets × 5; the rest × 10.

D. dipsacea: 1) top of flowering stem; 2) stipules; 3) leaflets; 4) bract, dorsal view; 5) flower + bract; 6) tip of androecium + inner petals; 7) banner, ventral view; 8) inner petals; 9) androecium.

D. obreniformis: 1) top of flowering stem; 2) stipules; 3) leaflets; 4) lowermost bract, profile; 5) upper bracts, profile and vertical views; 6) flower + bract; 7) banner, ventral view; 8) wing; 9) keel-petal; 10) androecium; 11) fruiting calyx; 12) pod.

PL. XLIII



DALEA DIPSACEA

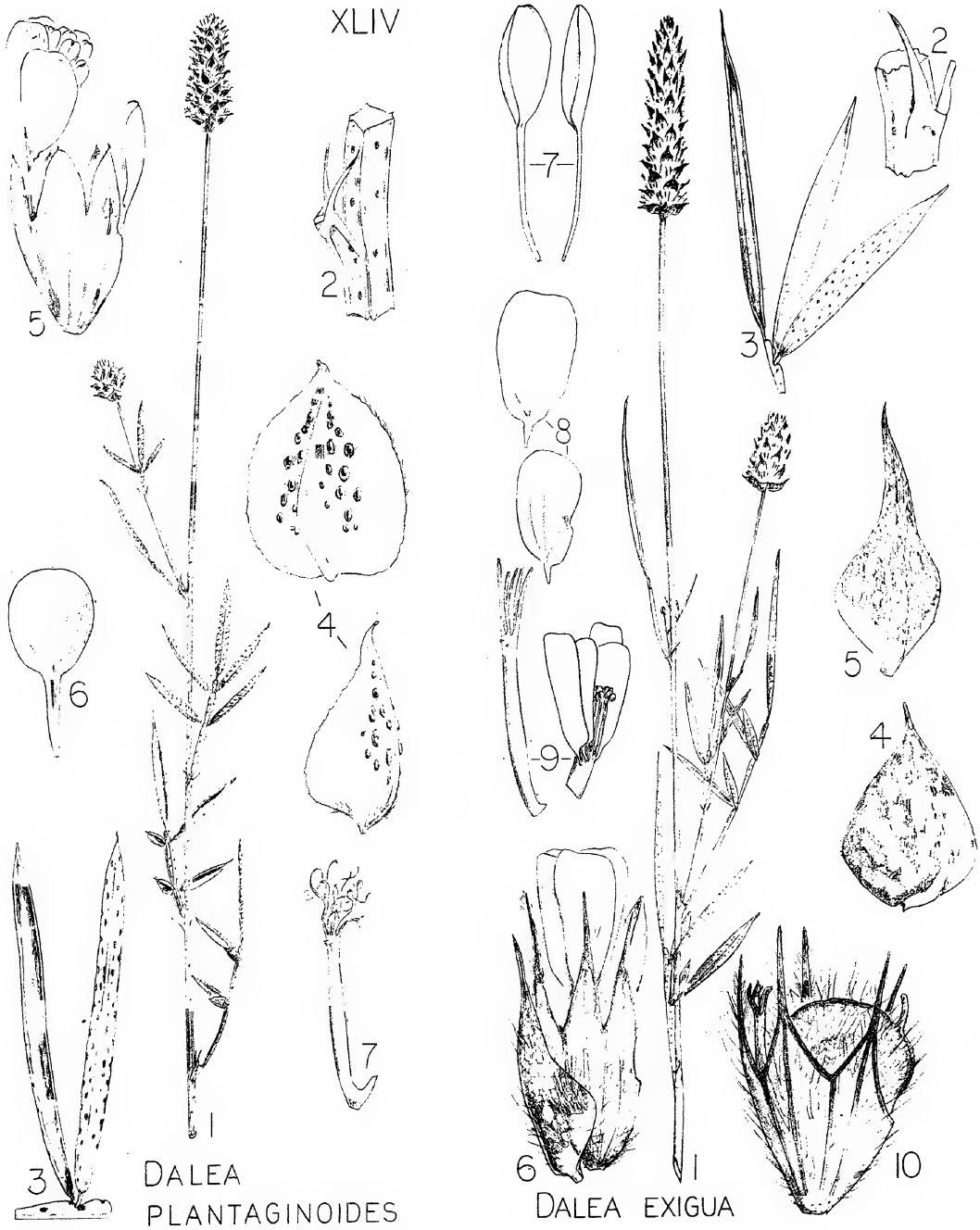
D. OBRENIFORMIS

PLATE XLIV

Dalea exigua Barneby and **D. plantaginoides** Barneby, stiffly erect, simple or few-branched herbs 1–4.5 dm tall, have sharply angled stems, green leaves dotted beneath, and dense spikes of persistent bracts terminal to all leafy axes. Both species inhabit open oak or pine forest and bear their tiny, caducous flowers during the late summer and fall months. The leaflets of *D. exigua* are thinly ciliate with long, weak, spiral hairs, the inner petals are vivid purple, and the androecium is reduced to 4–7 members of which only 4–6 bear fertile anthers. It is not uncommon in the northern Sierra Madre Occidental of central Chihuahua and adjoining Sonora and extends north to the headwaters of the Gila River in s.-w. New Mexico and s.-e. Arizona. The white-flowered *D. plantaginoides* is known only from three stations in n.-w. Michoacán and adjoining Jalisco, in the foothills of Volcán Tancítaro and vicinity. It has glabrous leaves, more shortly pointed calyx-teeth, and a full complement of ten stamens, all fertile. — Habit × 1; leaflets × 3; the rest × 10.

D. exigua: 1) top of stem; 2) stipules; 3) upper three leaflets; 4) dorsal view of lower bract; 5) do., upper bract; 6) flower + bract; 7) banner, ventral and profile views; 8) inner petals; 9) androecium, showing summit with petals in situ; 10) fruiting calyx + pod.

D. plantaginoides: 1) top of stem; 2) stipules; 3) pair of leaflets; 4) bracts, dorsal and profile views; 5) flower; 6) banner, ventral view; 7) androecium after anthesis.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DALEA
PLANTAGINOIDES
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DALEA EXIGUA

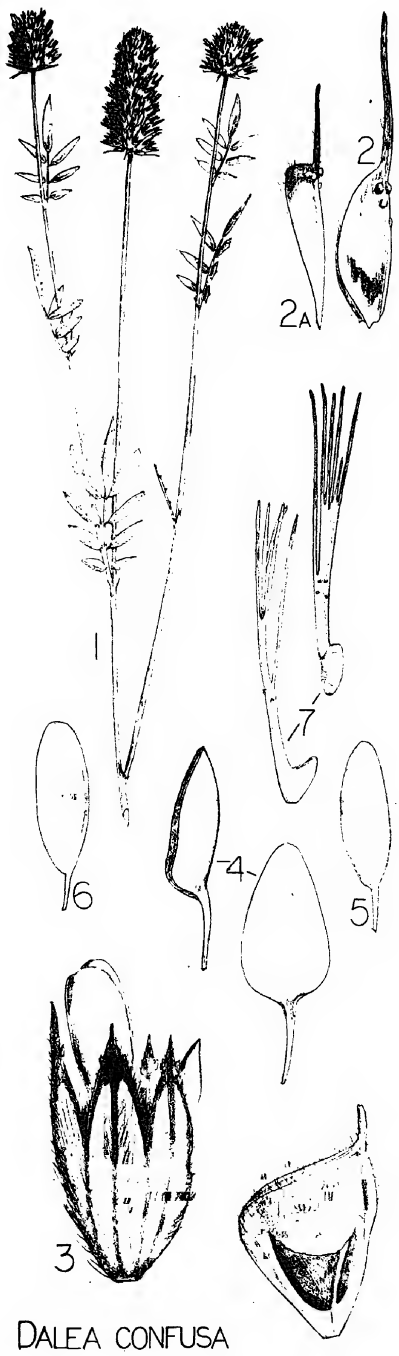
PLATE XLV

Dalea confusa (Rydberg) Barneby, a rare autumnal annual of w.-centr. Mexico, with stiffly erect stems, green foliage charged with a few long, weak spiral hairs, and minute purple flowers crowded into hard conelike heads. The species is uniquely modified ecologically, the only dalea known to inhabit wet muddy shores of ponds or ditches and moist swales in parkland. The typical form, var. **confusa**, is known only from the type-region near Ciudad Guerrero in Sierra Madre west of Ciudad Chihuahua; its flower has four epistemonous petals and the pod is half-obovate in profile, with dilated prow sloping upward to the terminal style-base. The var. **hexandra** Barneby, known from only two stations, one in e. Jalisco, the other in Michoacán, has only two epistemonous petals and a pod greatly dilated distally, suborbicular in profile, with a slender prow incurved through half a circle into an obliquely lateral style-base. —Habit × 1; the rest, except as noted, × 10.

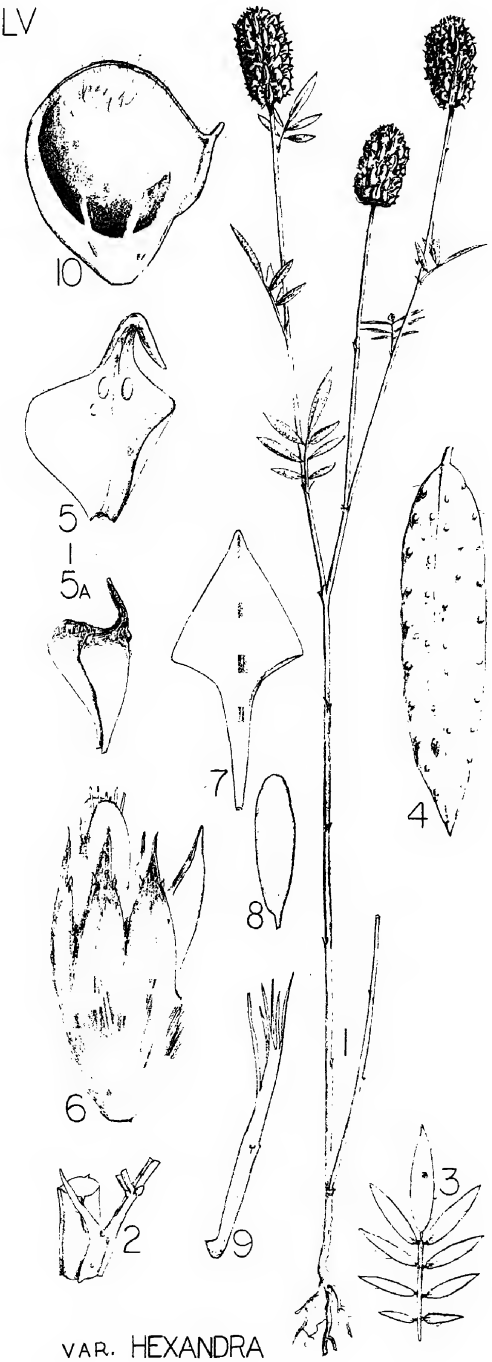
var. *confusa*: 1) top half of stem; 2) outer bract, profile view; 2a) interfloral bract, profile view; 3) flower; 4) banner, profile and ventral views; 5) wing; 6) keel-petal; 7) androecia, lateral and ventral views; 8) pod (young).

var. *hexandra*: 1) habit; 2) stipules × 5; 3) detached primary cauline leaf × 1; 4) leaflet, dorsal view × 5; 5) outer bract, ventral view; 5a) interfloral bract, profile view; 6) flower; 7) banner; 8) keel-petal; 9) androecium; 10) pod (mature).

PL. XLV



DALEA CONFUSA



VAR. HEXANDRA

PLATE XLVI

Dalea villosa (Nuttall) Sprengel and **D. emarginata** (Torrey & Gray) Shinners, both (at least functionally) pentandrous daleas, the former a true prairie-clover, perennial and with long filament-tassel, the latter a coarse annual or biennial herb, with flowers intermediate in morphology between sect. *Dalea* and sect. *Kuhnistera*. The foliage of *D. villosa* is finely pilose, in the low or diffuse var. **villosa** (figs. 1–10) densely so, usually ashen or silvery, and the petals vary from pale flesh-pink to rosy purple. The species is widespread on dunes and in deep sandy soils over the prairie provinces from s. Saskatchewan to the sources of the Red and Mississippi rivers, w. and s. to n.-w. New Mexico, w. Texas, and Oklahoma, and is represented in low sandy woodlands of e. Texas and adjoining Louisiana by the relatively tall, red-stemmed and green-leaved but otherwise similar var. **grisea** (Torrey & Gray) Barneby. Only bracts and calyx of *D. emarginata* are hairy, the foliage, crowded near base of the plant far below the long-stalked spikes being green or glaucescent beneath, often verdigris above when dry. The small flowers, opening in fall or spring, sometimes both, are vivid magenta-purple with yellow-golden anthers. The main range of *D. emarginata* lies around the Gulf Coastal Plain from s.-w. Louisiana to Veracruz, but extends feebly inland to the low hill-country of s.-centr. Texas. — Habit × 1; the rest × 5.

D. villosa var. *villosa*: 1) top of flowering stem; 2) stipules; 3) leaflets; 4) flower; 5) calyx, laid open; 6) banners, ventral view; 7) epistemonous petals from different plants; 8) androecium; 9) fruiting calyx; 10) pod.

D. villosa var. *grisea*: 3a) segment of stem + leaflets.

D. emarginata: 1) top of stem; 2) stipules; 3) leaflets; 4) outermost bract (dorsal view); 5) interfloral bracts (do.); 6) flower + bract; 7) calyx, laid open; 8) petals, all from one flower; 9) androecia; 10) fruiting calyx; 11) pods, profile and from above.

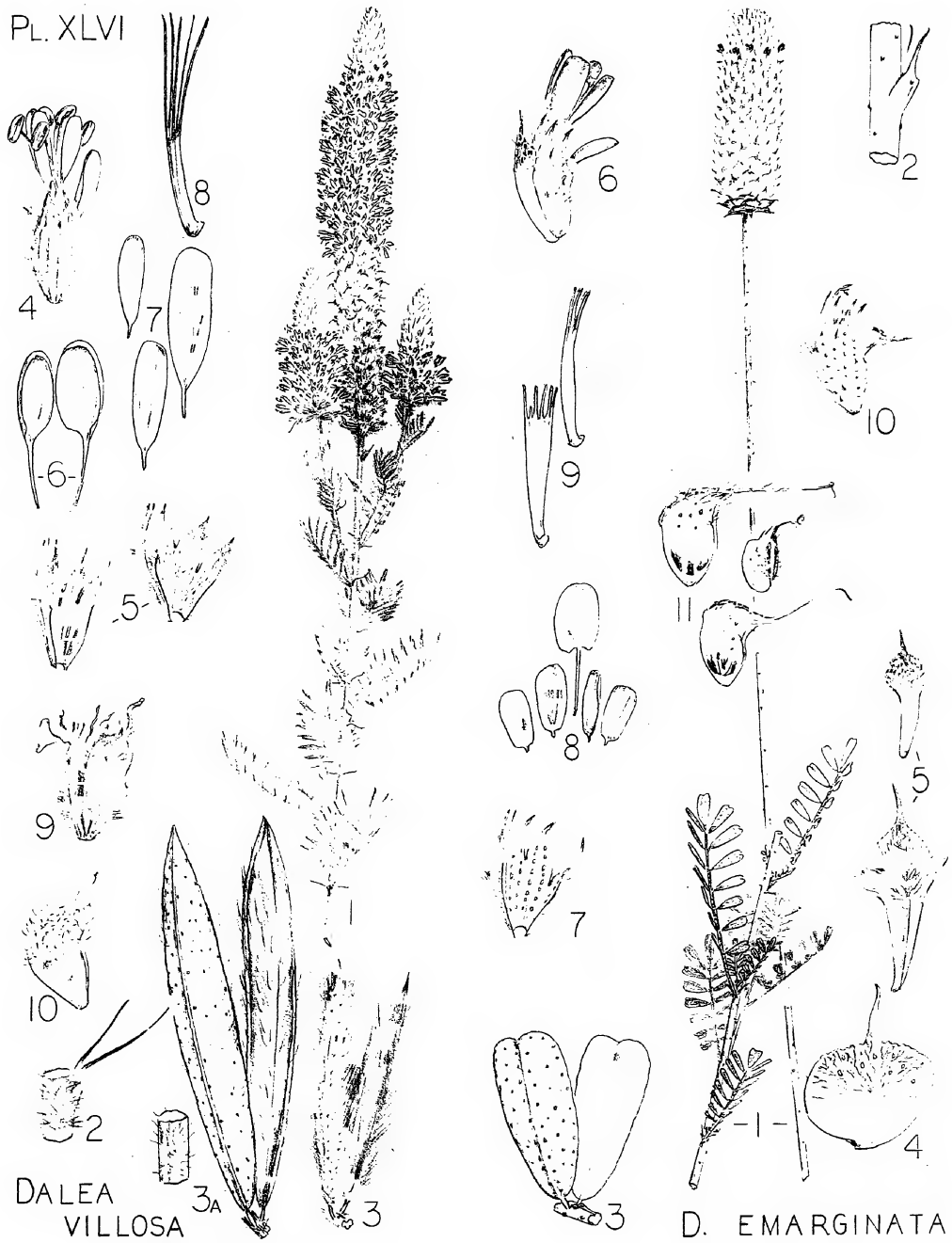
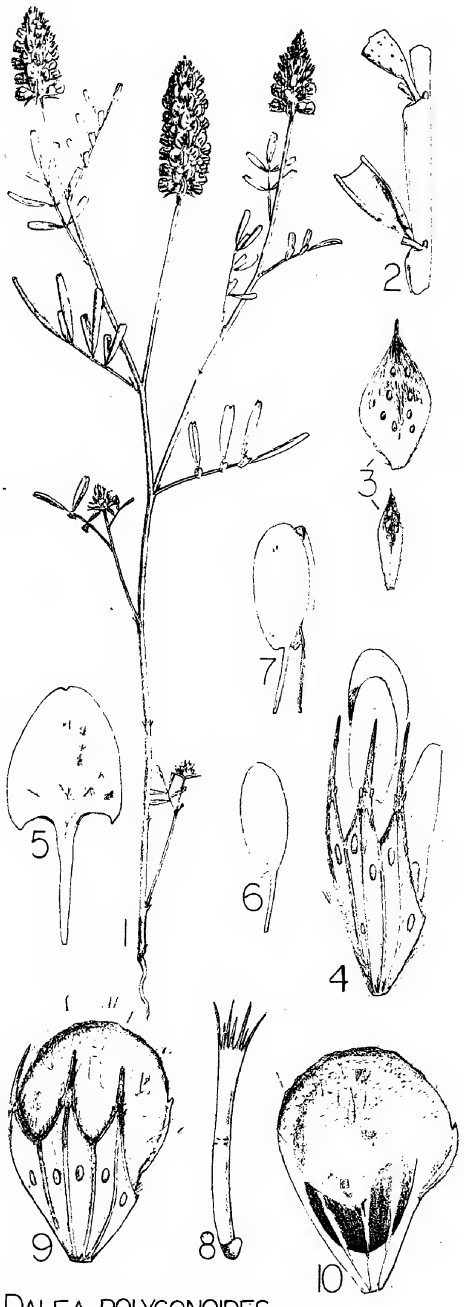

PL. XLVI
DALEA VILLOSA
D. EMARGINATA

PLATE XLVII

Dalea polygonoides Gray and **D. thouini** Schrank are obligately annual, glabrous below the spikes of flower, and may consist either of a single erect stem or of several incurved-ascending from near the ground. The leaflets of both are green above, paler beneath, the petals of the small vexillate flowers dull rose or purplish. Both are plants primarily of the oak and pine belts, where they reach maturity during the late summer and fall. The range of *D. polygonoides* extends over much of montane Arizona southward from the Flagstaff Plateau, east through the Mogollon Mountains to isolated stations in central New Mexico and the Davis Mountains in trans-Pecos Texas, and south interruptedly along Sierra Madre to central Durango. Note the solitary gland (sometimes 2) in each interval of the calyx, and the androecium reduced to 6–9 filaments of which only four or five bear fertile anthers. The range of *D. thouini* is (or now appears) bicentric. The species is locally common along the crest of the Neovolcanic Belt lying between the Nevado de Toluca and Popocatepetl, extending on the southern slope in Morelos down into the scrub zone as low as 1680 m; and disjunctly in pine-fir forest near the crest of Sierra Madre Occidental in central Durango, where *D. polygonoides* finds its southern limit. Features of *D. thouini* worth particular notice are the livid, almost black bracts shaggy internally with silver hairs, the gland-dotted petals, and shortly exserted anthers. Habit × 1; stipules and leaf-rachis × 5; the rest × 10.

D. polygonoides: 1) habit; 2) part of leaf-rachis + pedicels; 3) bracts, dorsal view; 4) flower; 5) banner; 6) wing; 7) keel; 8) androecium; 9) fruiting calyx (of the form with glabrous calyx-tube); 10) pod.

D. thouini: 1) habit; 2) stipules; 3) leaflets; 4) outer bract, ventral view; 5) inner bract, dorsal view; 6) flower; 7) banner, ventral view; 8) keel; 9) androecium + inner petals; 10) fruiting calyx; 11) pod.



DALEA POLYGONOIDES.

LXVII

DALEA THOUINI

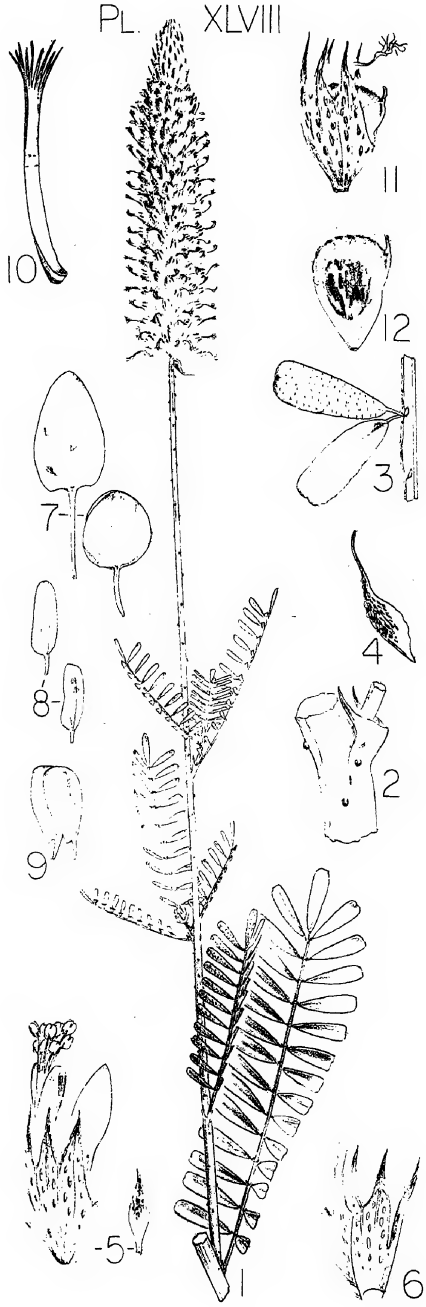
PLATE XLVIII

Dalea leporina (Ait.) Bullock, the most widely dispersed of all daleas, and the more local **D. exserta** (Rydb.) Gentry are coarse, leafy annual herbs, usually of weedy habit, reaching a stature of 5–15 dm and then paniculately branching from near the base or distally, but often depauperate, when simple and monocephalous. The plants of both species are glabrous to the inflorescence, with rich green foliage and leaflets at least ten pairs in the larger cauline leaves. The small fugitive flowers are most often blue, but in *D. leporina*, especially northward, may be white or whitish. Common characters of note are the dorsally recessed calyx-tube, a banner longer than the detached wings and keel, and the prominently exserted androecium. The small-flowered *D. leporina*, with calyx pilose externally from the base upward and an androecium ± 5–7 mm long, is the commonest of Mexican daleas, widespread in all the arid temperate and subtropical regions of the country and extending abundantly southward through the highlands of central America; northward it becomes less frequent and toward its northern limit on the United States prairies rare and scattered, but reaches outposts in Illinois, Minnesota, and North Dakota. In reappears, probably as an adventive but now fully naturalized, on the Andean plateau in Bolivia and southern Peru. The larger-flowered and much less common *M. exserta*, with calyx-tube glabrous externally and an androecium ± 8–11 mm long, is found in scattered stations, mostly in subtropical scrub at lower elevations than *D. leporina*, through s. Mexico, from Colima to Veracruz, s.-e. interruptedly to Costa Rica, and reappears sporadically in n. Sierra Madre Occidental in Sonora, Chihuahua, and extreme s. Arizona. — Habit × 1; the rest × 5.

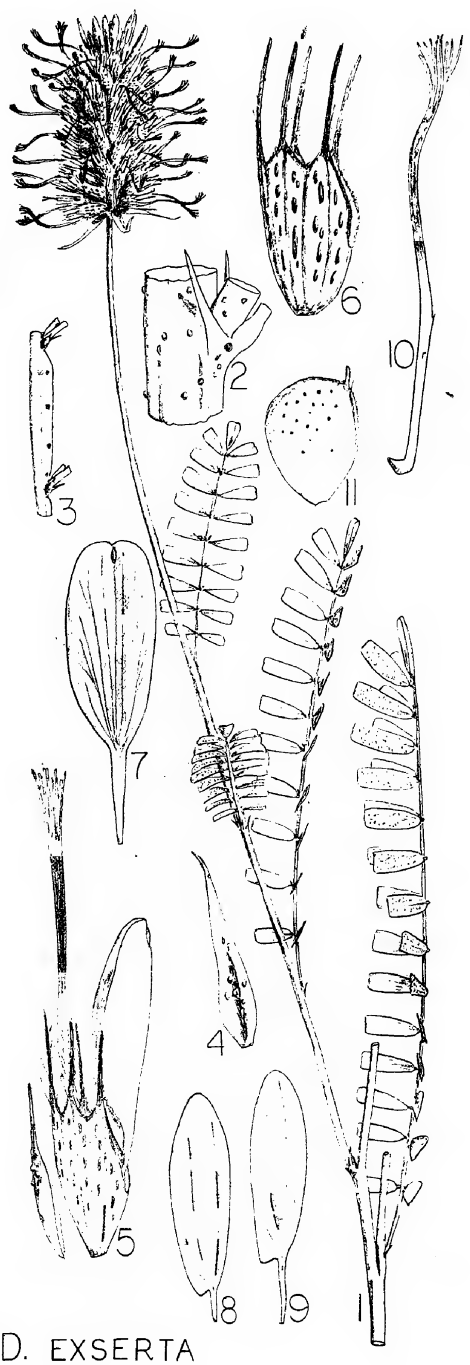
D. exserta: 1) branch of panicle; 2) stipules; 3) leaf-rachis + pedicels; 4) lower bract, dorsal view; 5) flower + inner bract; 6) fruiting calyx; 7) banner, ventral view; 8) wing; 9) keel-petal; 10) androecium; 11) pod.

D. leporina: 1) branch of panicle; 2) stipules; 3) leaflets; 4) lower bract, profile view; 5) flower at anthesis; the keel-petals shed, + inner bract, ventral view; 6) calyx, laid open; 7) banners, ventral view; 8) wings; 9) a single keel, the parts not united; 10) androecium; 11) fruiting calyx; 12) pod.

PL. XLVIII



DALEA LEPORINA



D. EXSERTA

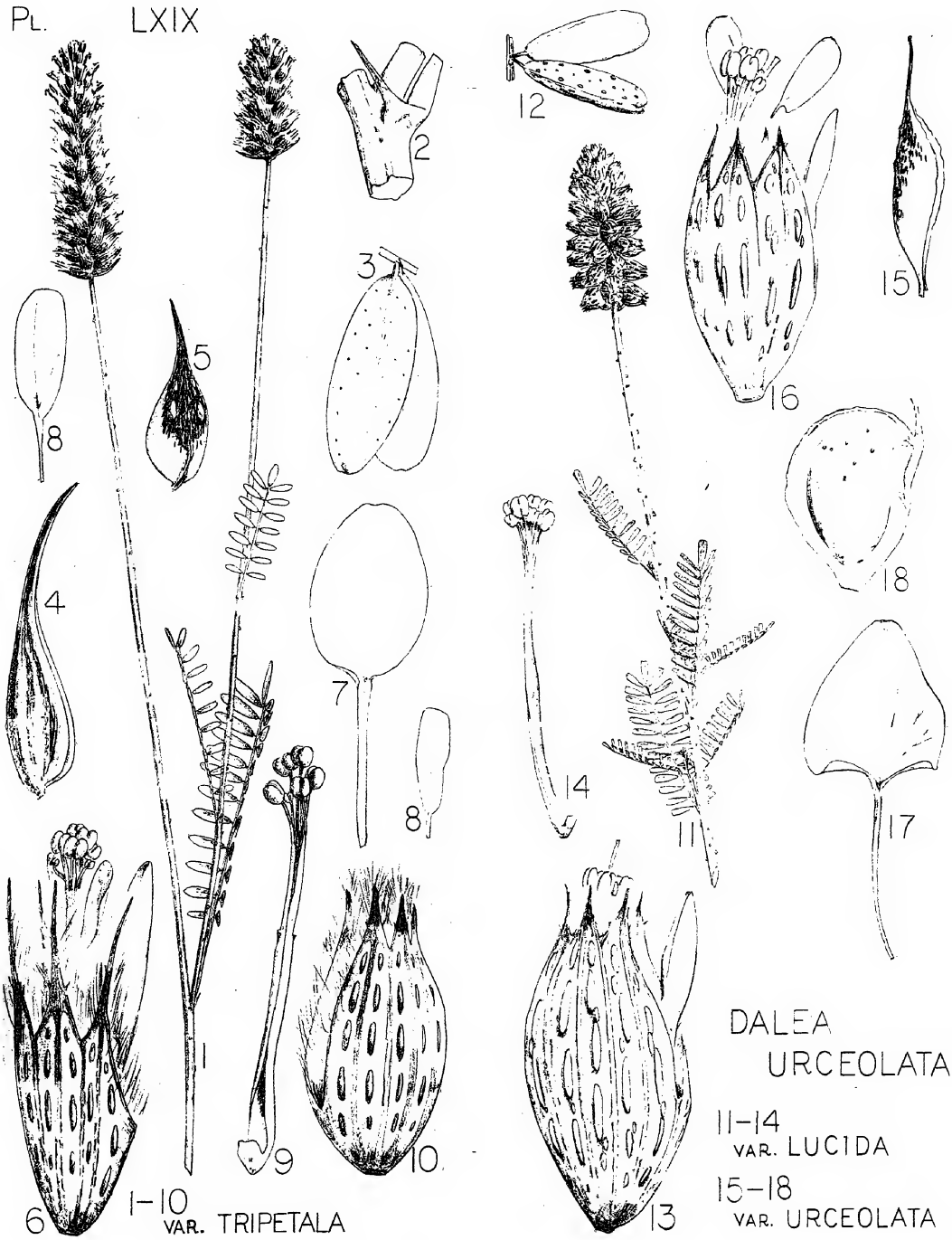
PLATE XLIX

Dalea urceolata Greene, a polymorphic annual of wide but discontinuous dispersal in Mexico's Transverse Volcanic Belt and Sierra Madre Occidental, extending n. into s.-w. United States. The plants may be erect and single-stemmed, branching from the middle upward, or several-stemmed from near the base; they are glabrous except for the fringed orifice of the calyx, which is deeply cleft on the adaxial side. The corolla is much reduced, the banner scarcely exserted and the minute, caducous, free inner petals never more than two and sometimes all lacking. The species is akin to the much commoner, sometimes sympatric *D. leporina*, differing in its tumid, externally glabrous calyx and a strong tendency toward suppression of the smaller set of five stamens. In var. **tripetala** (P. G. Wilson) Barneby, the form native to the pine belt (sometimes lower) between Volcán Colima and the cordillera lying between Ciudad México and Cuernavaca, the spike is relatively loose, two inner petals are present, and the androecium is reduced to five (sometimes with 1–2 smaller, interposed) members. The var. **urceolata**, ranging in oak-pine forest from w. Chihuahua into s.-w. New Mexico and centr. Arizona, has a more compact spike with petals again three, but an androecium mostly 7–10-merous. The var. **lucida** (Rose) Barneby inhabits a more arid belt in the grasslands along the e. foothills of the Sierra Madre in Durango; with the spike and androecium of var. *urceolata* it has more numerous, firmer and smaller leaflets and the corolla is reduced to the banner alone. All forms of *D. urceolata* flower in late summer and fall, var. *tripetala* sometimes continuing into early winter. The petals vary from whitish to pale blue. — Stems (figs. 1, 11) × 1; leaflets (figs. 3, 12) × 5; the rest × 10.

1–10, var. *tripetala*: 1) top of stem; 2) stipules; 3) leaflets; 4) lower bract, profile; 5) upper bract, dorsal view; 6) flower at early anthesis; 7) banner, ventral view; 8) inner petal; 9) androecium; 10) fruiting calyx.

11–14, var. *lucida*: 11) top of stem; 12) leaflets; 13) flower at anthesis; 14) androecium.

15–18, var. *urceolata*: 15) bract, profile; 16) flower at anthesis; 17) banner, ventral view; 18) pod.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1–10 VAR. TRIPETALA
DALEA URCEOLATA
11–14 VAR. LUCIDA
15–18 VAR. URCEOLATA

PLATE L

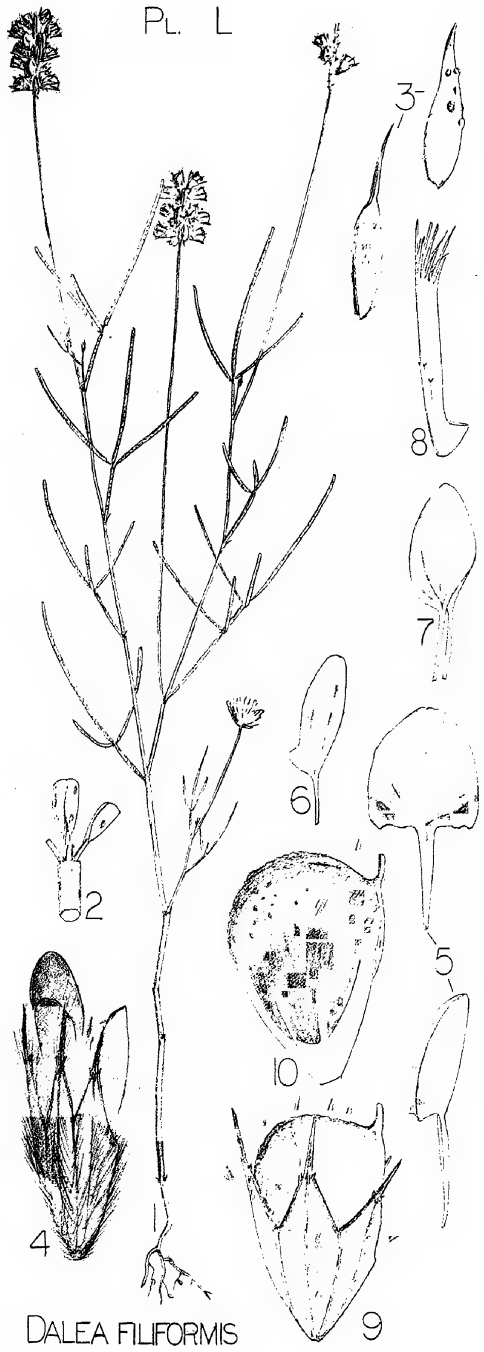
Dalea filiformis Gray and **D. transiens** Barneby are erect annuals germinating during summer rains and forming part of the late summer and fall flora of the northern Sierra Madre Occidental. Both are glabrous (or nearly so) below the finely pilosulous spikes of tiny lilac or reddish flowers, from which the bracts fall away before the petals expand. The leaves of *D. filiformis*, consisting of either three or five exactly linear, proportionately very long leaflets, distinguish the species at a glance; its keel-petals are united along the outer edges and enclose a decandrous androecium. The range of *D. filiformis* extends the length of the Sierra in Chihuahua and north around the edges of the Gila Basin through southwestern New Mexico and the Mogollon Rim to the Hualpai Mountains in western Arizona; also feebly across into Sonora and south to central Durango. The much rarer *D. transiens* is known only from the interior piedmont of the Sierra in central Durango, where it occurs in thin oak-woods transitional to the plateau grasslands. It differs from *D. filiformis* in having 2–5 pairs of shorter, proportionately broader leaflets, the keel-parts free even in the bud, and an androecium reduced to five, six, or seven members. Inflorescence and habit × 1; leaflets of *D. transiens* (fig. 3) × 5; the rest × 10.

D. filiformis: 1) habit; 2) tip of leaf-rachis + pedicels; 3) bracts, outer and inner, both profile view; 4) flower; 5) banner, ventral and profile views; 6) wings; 7) keel; 8) androecium; 9) fruiting calyx; 10) pod.

D. transiens: 1) upper half of plant; 2) leaf-rachis + pedicels; 3) leaflets, dorsal and ventral views; 4) bract; 5) flower; 6) banner; 7) wing; 8) one keel-petal; 9) androecium; 10) fruiting calyx.

DALEA TRANSIENS

PL. L



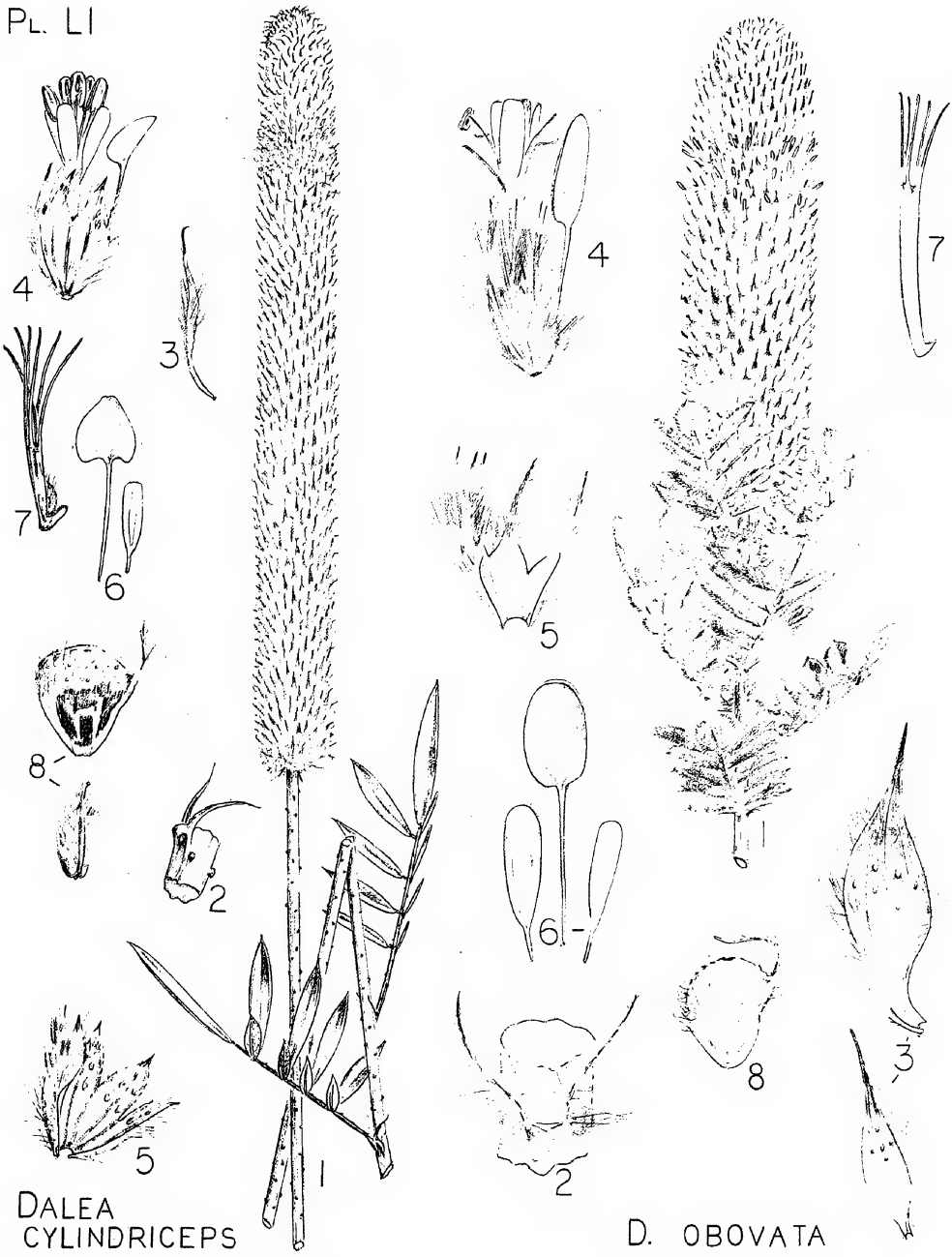
DALEA FILIFORMIS

PLATE LI

Dalea cylindriceps Barneby and **D. obovata** (Torrey & Gray) Shinners, coarsely leafy herbs of short duration but not truly monocarpic, notable for their massive spikes of countless, densely packed calyces and for the small size of the fleeting, white or pallidly roseate petals. Both are confined to sandy soils, *D. cylindriceps* widely and discontinuously dispersed over the higher prairies, at 900 m upward, from s.-w. South Dakota to w. Texas and the Rio Grande valley in New Mexico, *D. obovata* endemic to the Coastal Plain of southern Texas; both flower in summer, over a period of three months or more. The warty stems and the leaflets of *D. cylindriceps* are glabrous, and the spikes, about 1 cm diameter, are raised well above the foliage. The whole plant of *D. obovata* is gray-pilose with fine silky hairs and the stouter, often shorter spikes, 1.5–2 cm diameter, are nearly sessile. — Inflorescences × 1; the rest × 5.

D. cylindriceps: 1) top of stem; 2) stipules; 3) bract, profile view; 4) flower; 5) calyx, laid open; 6) petals, the banner in ventral view; 7) androecium + ovary; 8) pod, profile and vertical views.

D. obovata: 1) top of stem; 2) stipules; dorsal view; 3) interfloral bracts, both ventral view; 4) flower; 5) calyx, laid open; 6) petals, the banner in ventral view; 7) androecium; 8) pod.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DALEA
CYLINDRICEPS
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D. OBOVATA

PLATE LII

Dalea ornata (Douglas) Eaton & Wright and **D. flavescens** (Watson) Welsh, prairie-clovers of arid lowlands in intermountain w. United States, with broad leaflets of thick texture and permanently dense spikes carried in early summer well above the foliage on naked peduncles. The purple- or pink-flowered *D. ornata* is the most northerly dalea w. of the Rocky Mountains, extending from the Columbia Basin in e. Washington to the Snake River plains in s. Idaho and s. through transmontane Oregon into n.-w. Nevada, the only species of the genus in this range. Its foliage is always glabrous and pallidly glaucescent, and the orifice of the nearly always softly long-villous, submembranous calyx-tube is almost symmetrical. The white-flowered *D. flavescens*, endemic to the sandstone canyon country of the Colorado Plateau in s.-e. Utah and n. Arizona, varies in vesture, the stems and foliage most commonly pilose but hardly canescent yet sometimes fully glabrous; the interfloral bracts, the calyces (and consequently the diameter of the spike whether short or longer) and the androecia are uncommonly variable in length but the relatively firm calyx-tube is always deeply recessed behind the banner, resembling that of the vicariant but purple-flowered *D. searlsiae* (Pl. LIII). — Spikes and parts of stems × 1; the rest × 5.

D. ornata: 1) spike and segment of mid-stem; 2) stipules; 3) flower + bract; 4) bract, ventral and dorsal views; 5) petals, from different plants, the banner in ventral view; 6) calyx, laid open; 7) pod.

D. flavescens: 1) narrow spike + its small flower; 2) broader short spikes; 3) long thick spike + 3a) its flower + 3b) its bract (these from paratypus of *D. epica* Welsh); 4) segment of mid-stem (glabrous form); 5) calyx of average size, laid open; 6) banner, ventral view; 7) pod; 8) flower of minor variant (*Holmgren & Goddard 9990*) with glabrescent, long-toothed, glandular calyx.

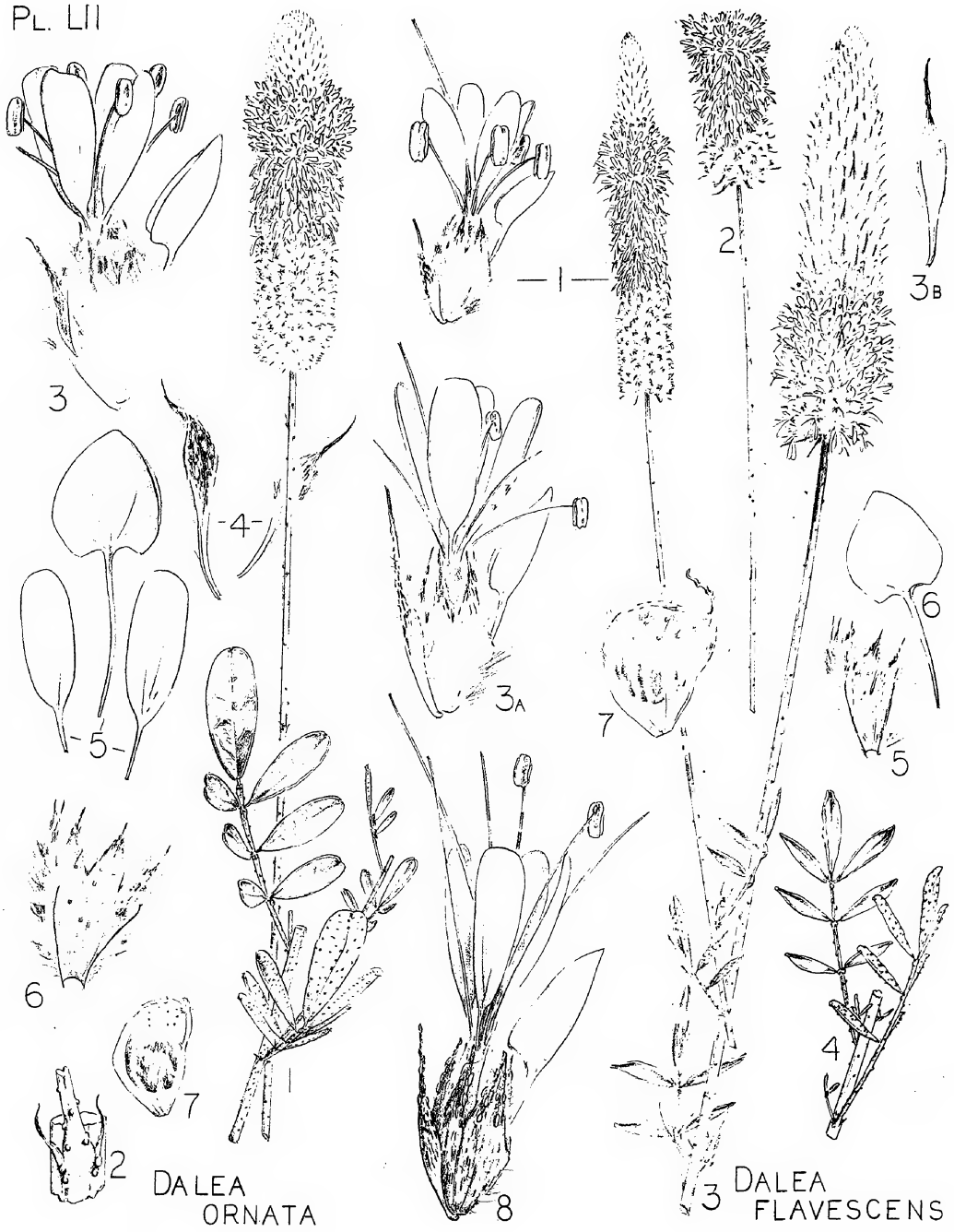

PL. LII
1
2
3
3A
3B
4
5
6
7
8
DALEA ORNATA
DALEA FLAVESCENS

PLATE LIII

Dalea searlsiae (Gray) Barneby and **D. scariosa** Watson, prairie-clovers of arid Southwestern United States, with thick-textured, glaucescent foliage and moderately dense spikes of rose-purple flowers. The virgate stems of *D. searlsiae*, which ranges over the w. half of the Great Basin into the n. and e. Mohave Desert and n.-w. Arizona, are erect-ascending and simple or few-branched; the leaves vary from glabrous to pilosulous, and the flowers mature in late spring and early summer, seldom later than mid-July. The much rarer *D. scariosa*, confined to bluffs of the Rio Grande valley in n.-centr. New Mexico, flowers in late summer, from August onward; the foliage and outer surface of the calyx are always glabrous; and the stems are diffusely trailing and freely branched to form fan-shaped sprays of many spikes. A character common to both is a calyx deeply recessed behind the banner and in fruit constricted just above the base. — Branchlets × 1; the rest × 5.

D. searlsiae: 1) tip of flowering stem; 2) leaf from middle of stem (the villosulous form); 3) stipules; 4) bract; 5) flower; 6) petals, the banner in ventral view; 7) androecium + gynoecium at late anthesis; 8) fruiting calyx; 9) pod.

D. scariosa: 1) summit branchlet, in fruit; 2) stipules; 3) leaflets; 4) bract, profile and dorsal views; 5) flower; 6) banner, ventral view; 7) wing-petal; 8) keel-petal; 9) androecium; 10) fruiting calyx; 11) pod.

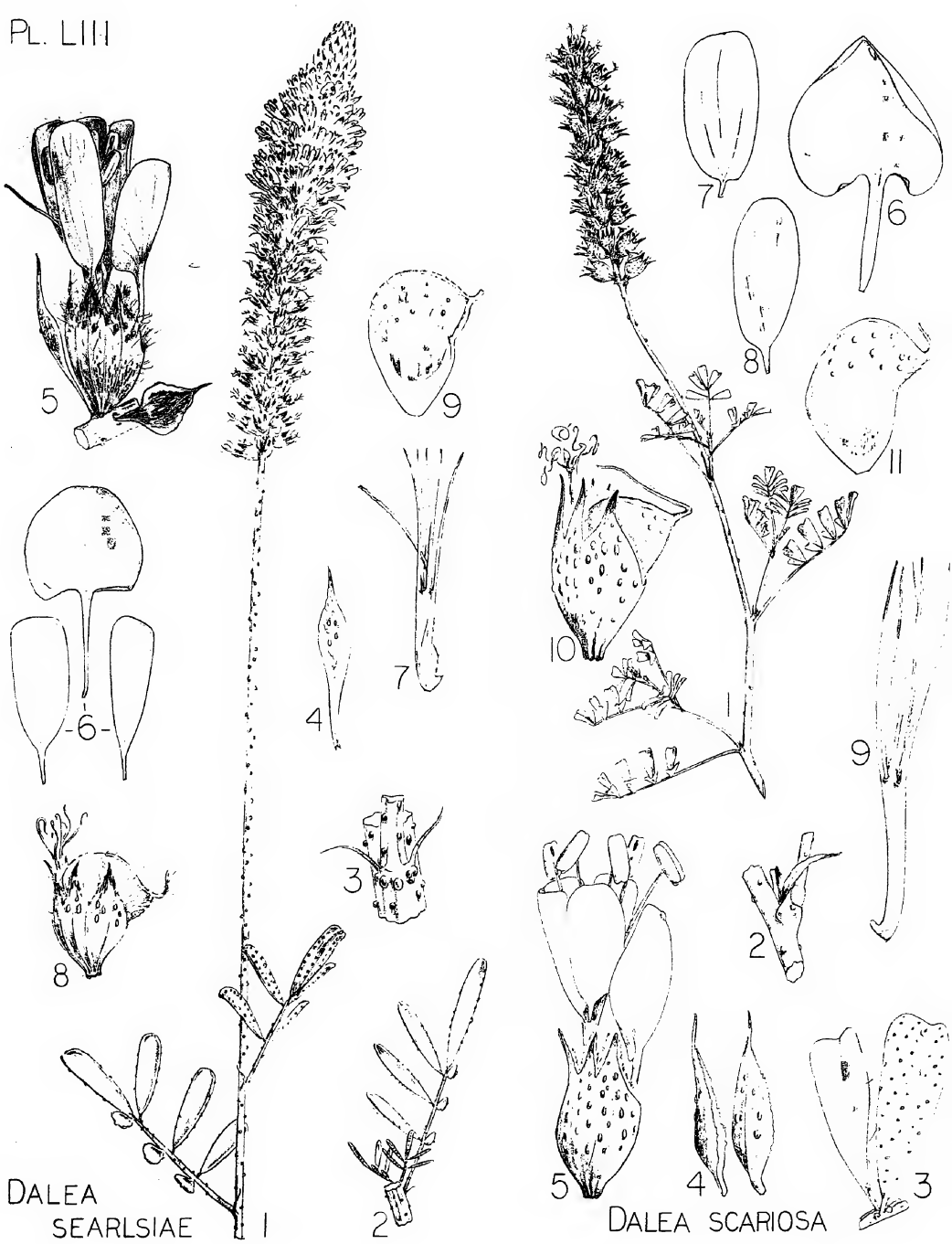

PL. LIII
5
9
6
4
7
8
3
1
2
DALEA
SEARLSIAE
7
6
8
11
10
1
9
2
5
4
3
DALEA SCARIOSA

PLATE LIV

Dalea phleoides (T. & G.) Shinners, **D. bartoni** Barneby and **D. sabinalis** (S. Wats.) Shinners are Texan prairie clovers, the first mostly calcifuge and widely dispersed to n. and e. of Edwards Plateau and extending weakly into Oklahoma and Louisiana, the others calciphile, endemic and highly localized, *D. sabinalis* around the s. margin of Edwards Plateau and *D. bartoni* in the Big Bend Country. All have spiculiform bracteoles subtending each flower and a highly oblique calyx charged with many raised blister-glands. The white-flowered *D. phleoides* has leaflets relatively few and large combined with glabrous calyx in var. **phleoides**, many and smaller with often pilosulous calyx in var. **microphylla** (T. & G.) Barneby. The spikes are permanently dense, and the epistemonous petals notably narrow and ribbon-like. The tall, pink-flowered *D. sabinalis* has in common with the dwarf white-flowered *D. bartoni* a characteristic pear-shaped calyx constricted and somewhat pleated at base. The differences in number and shape of leaflets and in length of peduncle and spike are apparent from the figures. — Flowering stems × 1; the rest × 5.

D. phleoides var. *phleoides*: 1) top of flowering stem; 2) flower, with bract and bracteole; 3) bract, ventral view; 4) petals, the banner in ventral view.

D. phleoides var. *microphylla*: 5) top of flowering stem; 6) flower + bract and bracteoles persistent on segment of spike-axis; 7) pod.

D. bartoni: 1) flowering stem; 2) flower at late anthesis, the anthers and epistemonous petals shed; 3) bract, dorsal view; 4) banner, ventral view; 5) epistemonous petal; 6) pod.

D. sabinalis: 1) top of flowering stem; 2) leaflet, ventral view; 3) flower; 4) petals, the banner in ventral view.

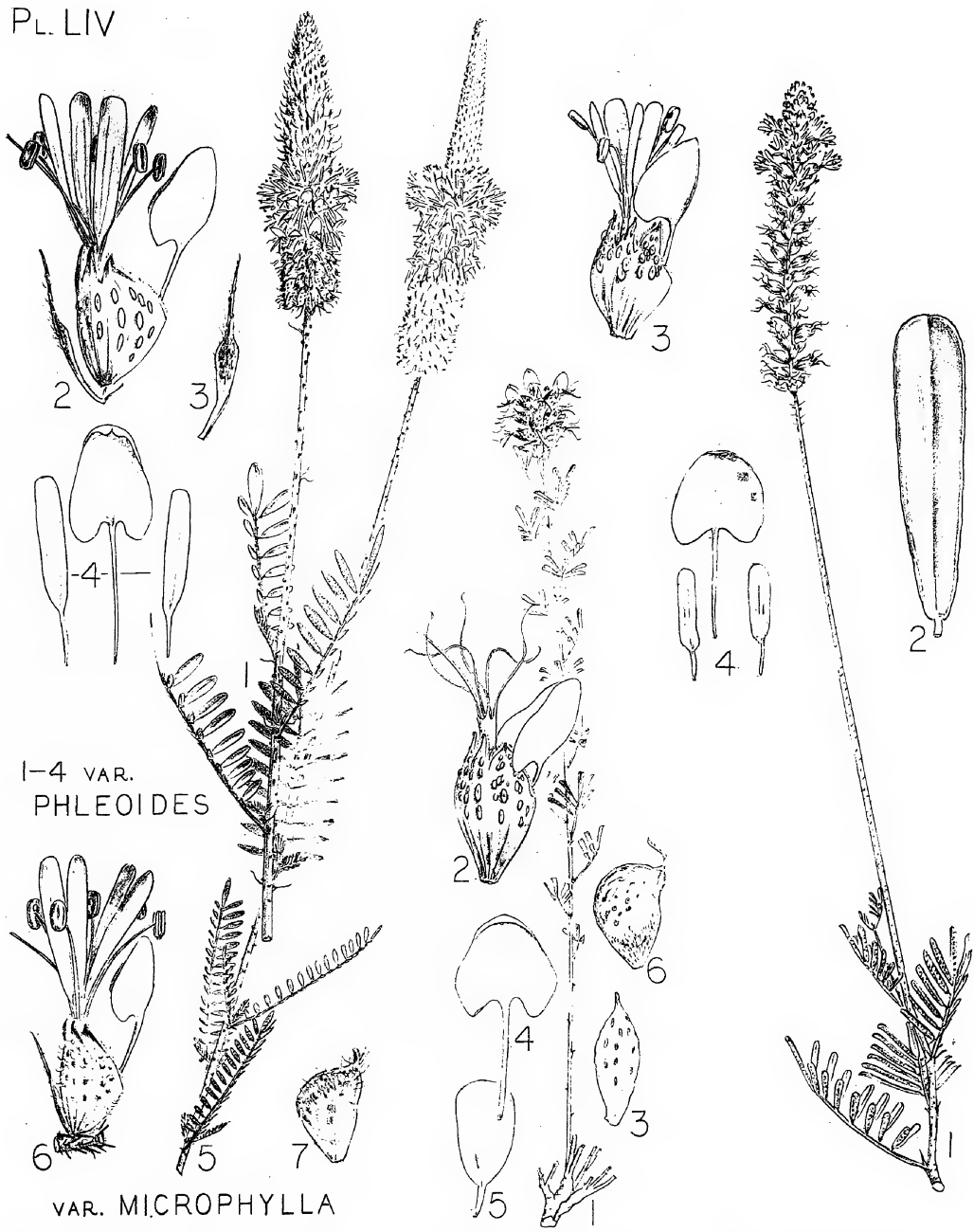
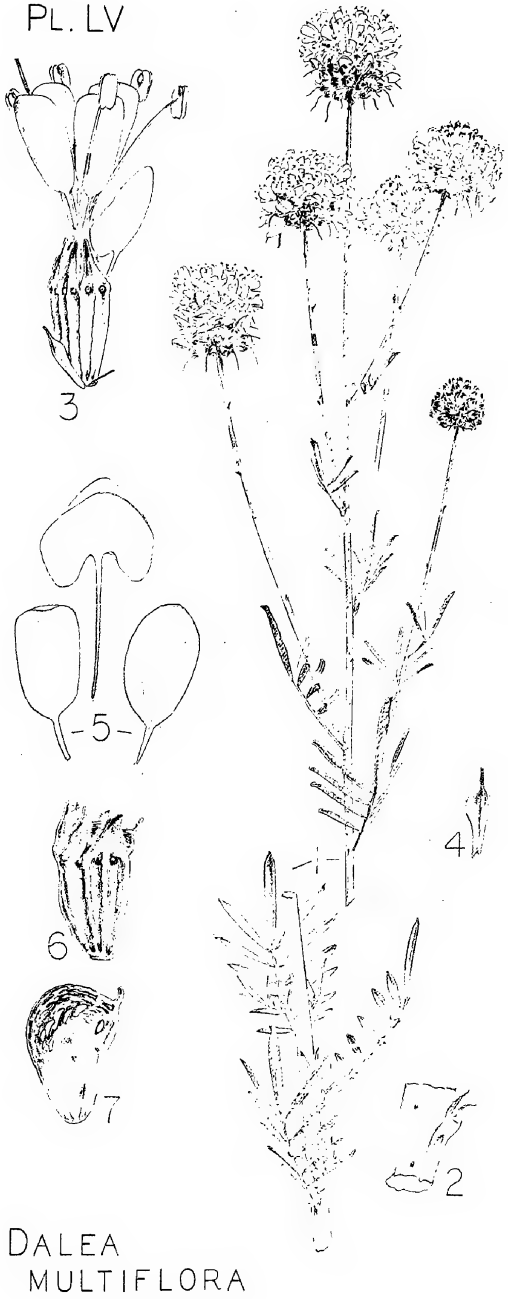

PL. LIV
2
3
4
1
1–4 VAR.
PHLEOIDES
6
5
7
VAR. MICROPHYLLA
DALEA PHLEOIDES
3
2
4
6
5
1
D. BARTONI
2
4
1
3
D. SABINALIS

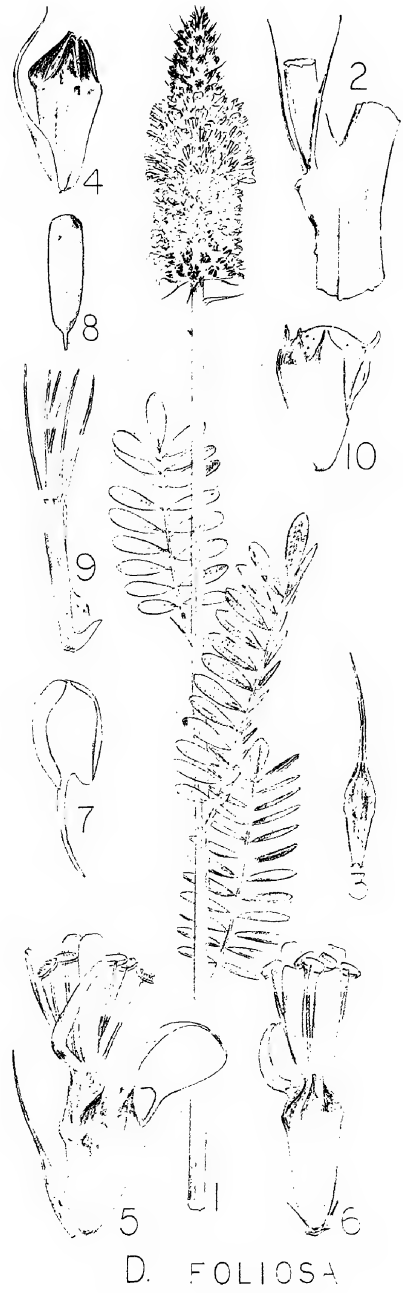
PLATE LV

Dalea multiflora (Nuttall) Shinners and **D. foliosa** (Gray) Barneby, glabrous prairie-clovers of centr. and s.-centr. United States, are herbs about 3–7 dm tall, flowering in summer and early fall. Both have green foliage and hard, conelike spikes of calyces, each subtended by a pair of bracteolar spicules. The white-flowered *D. multiflora*, a relatively common plant dispersed from the Gulf Coast and Edwards Plateau in Texas to Kansas and w. Missouri, also southward feebly into n.-e. Mexico, differs from *D. candida* (Pl. LVII) in its subglobose or shortly oblong spikes combined with 3–6 pairs of leaflets in the larger cauline leaves. The purple-flowered *D. foliosa* of central Tennessee and adjoining Alabama, where it forms part of the calciphile cedar-glade flora, and of river-bluffs and -gravels in n. Illinois, differs from all related species in its many expanded leaflets. — Habit × 1; the rest × 5.

D. multiflora: 1) top and middle-segment of stem; 2) stipules; 3) flower + bract; 4) bract, ventral view; 5) petals, all from different plants; 6) fruiting calyx; 7) pod.

D. foliosa: 1) top of stem; 2) stipules; 3) bract, ventral view; 4) flower-bud + bract; 5) flower + bract, profile view; 6) flower, ventral view; 7) banner, ventral view; 8) epistemonous petal; 9) androecium + gynoecium; 10) fruiting calyx + pod.


PL. LV
3
1
4
5
6
7
2
DALEA
MULTIFLORA


4
2
8
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5
11
6
D. FOLIOSA

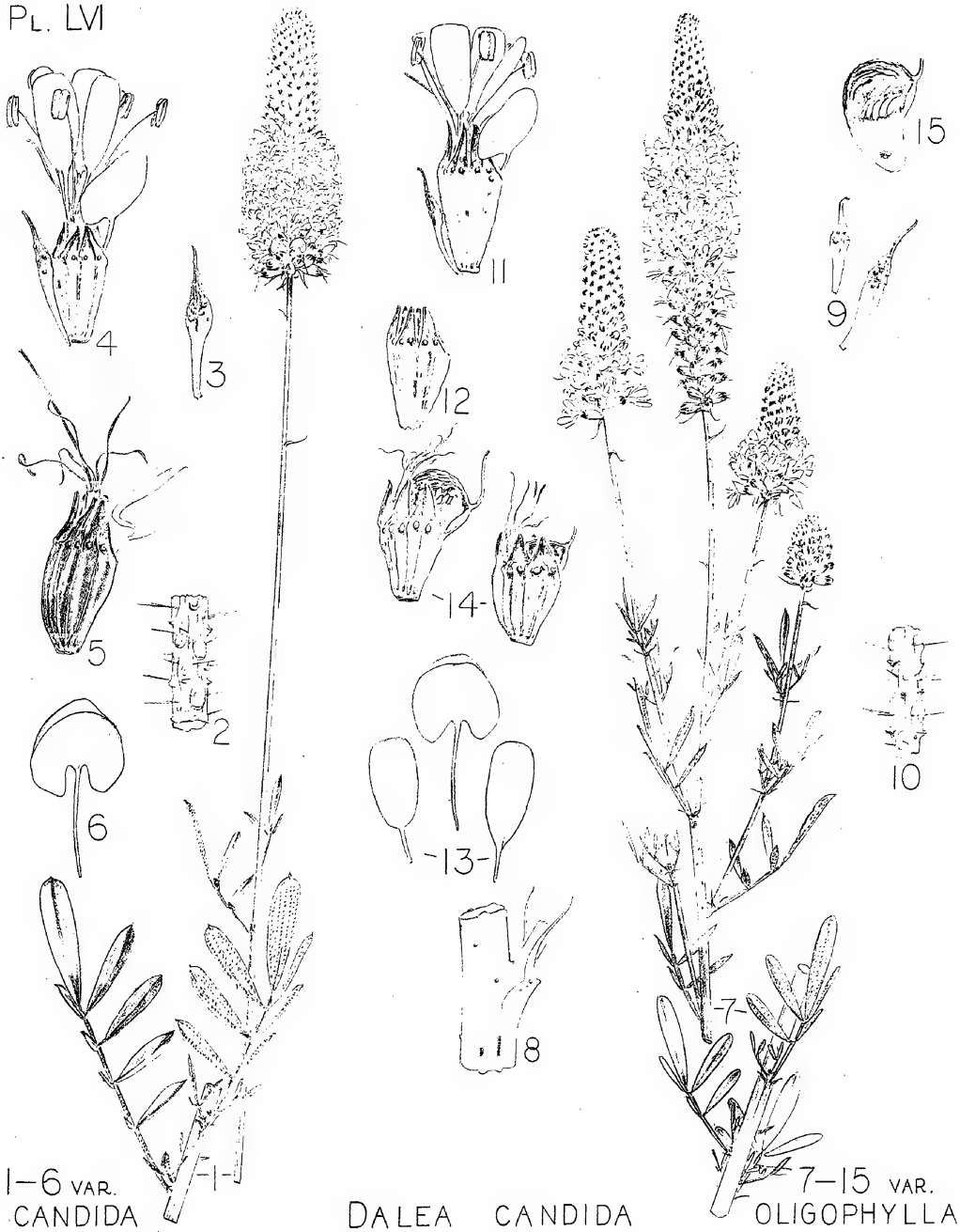
PLATE LVI

Dalea candida Michaux ex Willdenow, the most widely dispersed of the prairie-clovers, has glabrous stems and leaves, dark green or pallid and inconspicuously dotted, and in summer, well above the foliage, tassels of white petals sparked with golden anthers. The species if variable in habit of growth, with either erect or diffuse herbaceous stems 3–10 dm long, usually branched above middle and several-headed, sometimes branched throughout, exceptionally simple. The eastern var. **candida**, of rich lowlands in middle-western United States extending n. into e. Canada and s. to e. Texas, more rarely w. along rivers into the higher plains, has mostly erect, virgate stems and 3–4 pairs of ample leaflets in larger stem-leaves; the spike is always dense, the calyx always glabrous externally, and the bracts are commonly exserted beyond the buds. The var. **oligophylla** (Torrey) Shinners, a polymorphic assemblage of more xerophytic forms dispersed over the short-grass prairies from s. Canada to centr. Kansas and w. Texas, w. to Utah, Arizona, and Durango, and e. on bluffs well into the lowland range of var. *candida*, differs principally in the looser spike. This is usually accompanied by fewer, smaller leaflets, shorter interfloral bracts, and often by an externally puberulent calyx. Note the bracteolar spicules (figs. 2, 10) which persist on the spike-axis of *D. candida* after the calyx falls, a feature characteristic of ser. *Candidae* (Plates LIV–LVII). — Habit × 1; the rest × 5.

var. *candida*: 1) segment of mid-stem and terminal spike; 2) segment of spike-axis; 3) interfloral bract, dorsal view; 4) flower at early anthesis + bract; 5) do. at late anthesis; 6) banner, ventral view.

var. *oligophylla*: 7) segment of mid-stem and part of panicle; 8) stipules; 9) bracts, dorsal view; 10) segment of spike-axis; 11) flower + bract, as early anthesis; 12) calyx; 13) petals, from different flowers; 14) fruiting calyces; 15) pod.

PL. LVI



1–6 VAR. CANDIDA

DALEA CANDIDA

7–15 VAR. OLIGOPHYLLA

PLATE LVII

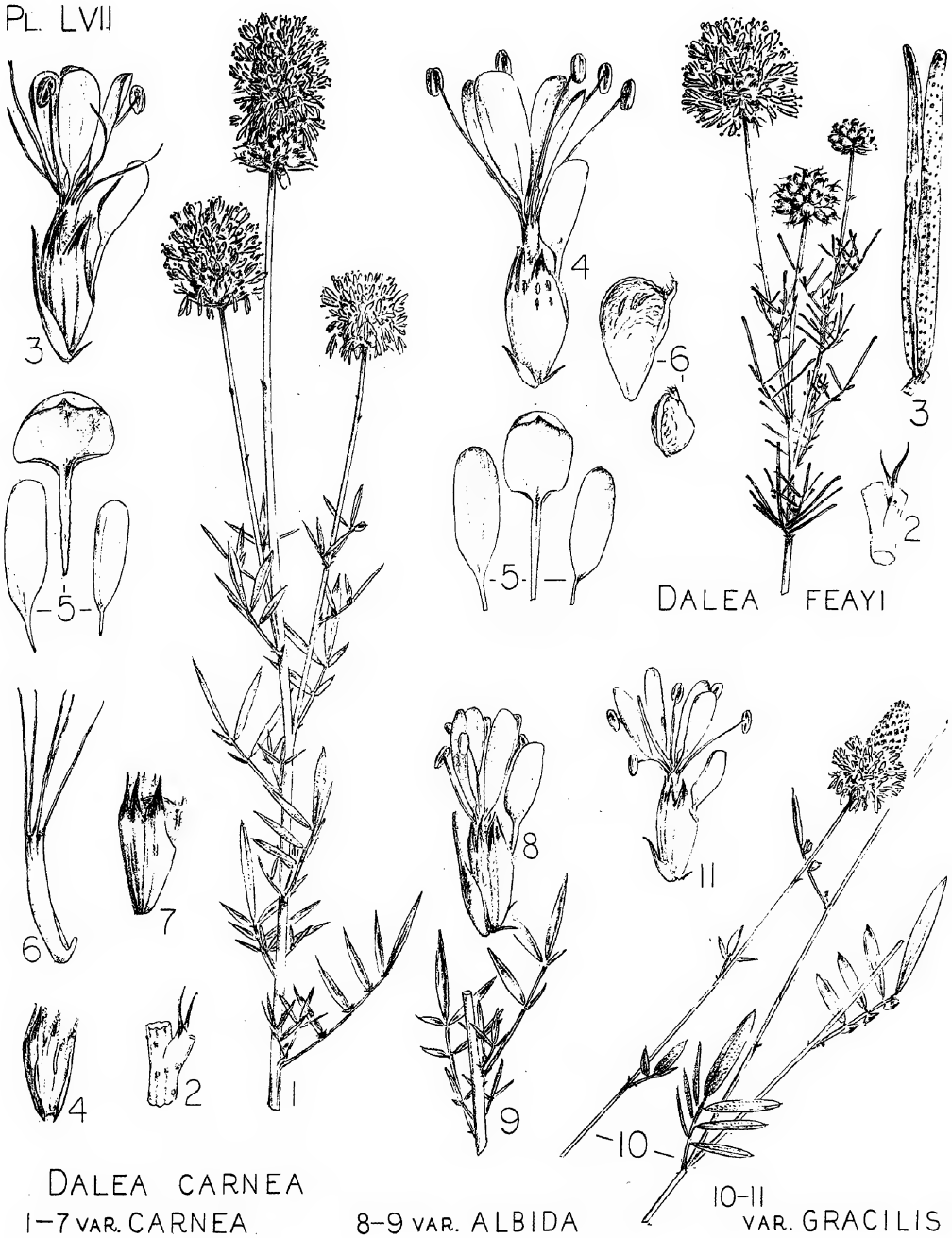
Dalea carnea (Michaux) Poiret and **D. feayi** (Chapman) Barneby, prairie-clovers of peninsular Florida, the former dispersed n. and n.-w. on the coastal plains to centr. Georgia and lower Louisiana, the latter only n., and that interruptedly, to Georgia. Both are glabrous except for the asymmetric orifice of the calyx and inconspicuously glandular; they are flowers of late summer and fall, but in frostless s. Florida may remain in active growth throughout the year. The polymorphic *D. carnea* consists of three varieties, a robust, erect, pink-flowered var. **carnea** with 7–9 leaflets in most primary cauline leaves, of low moist savannah country between s.-e. Georgia and the Everglades; a diffuse, very slender, white-flowered var. **gracilis** (Nuttall) Barneby with smaller calyces, of similar habitat but dispersed from w. Florida around the Gulf to Lake Pontchartrain; and var. **albida** (Torrey & Gray) Barneby, resembling var. *carnea* in stature and var. *gracilis* in the small white flowers, but with mostly 5-foliolate cauline leaves and adapted to drier, sandy woodlands in n.-centr. Florida and n. to centr. Georgia. The related *D. feayi* has almost the flower of *D. carnea* var. *carnea* and is found in the same latitudes but chiefly on white sand-barrens; it is a many-stemmed bushy, eventually suffruticose herb 3–7 dm tall, notable for the extreme fineness of the foliage and the repeatedly branched panicles of small globose flower-spikes. — Habit and segments of stem × 1; the rest × 5.

Dalea carnea var. *carnea*: 1) top of stem; 2) stipules; 3) flower + bract and bracteole; 4) calyx, laid open; 5) banner (ventral view) and epistemonous petals from different plants; 6) androecium; 7) fruiting calyx.

Dalea carnea var. *albida*: 8) flower; 9) segment from mid-stem.

Dalea carnea var. *gracilis*: 10) top of stem with a segment from mid-stem; 11) flower.

Dalea feayi: 1) division of panicle; 2) stipules; 3) leaflets; 4) flower; 5) petals, all from one flower; 6) pod, profile and seen from above.


PL. LVII
3
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7
4
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1
4
6
5
3
2
DALEA FEAYI
8
9
11
10
DALEA CARNEA
1–7 VAR. CARNEA
8–9 VAR. ALBIDA
10–11
VAR. GRACILIS

PLATE LVIII

Dalea purpurea Ventenat, prototype of the purple prairie-clovers, a polymorphic species dispersed over the prairies from s.-w. Canada to n.-e. New Mexico and n. Texas, e. to the Ohio River and centr. Alabama, and the related **D. compacta** Sprengel of centr. and e. Texas and adjoining states, differing in the larger calyx, glabrate externally except for lines of silvery pubescence leading to the sinuses between the teeth. In the Mississippi Valley typical *D. purpurea* is commonly a tall virgate herb (to 9 dm), the stems branching at the top into a panicle of few or several heads; w.-ward it is represented by mostly dwarfer forms, often diffuse, commonly monocephalous. The foliage is inconspicuously pilosulous, seldom glabrous, rarely gray-pilose. Over most of the range the relatively massive spike is elevated little above the leaves but on the short-grass prairies between w. Kansas and n.-w. Texas the dominant form is var. **arenicola** (Wemple) Barneby, poorly distinguished by a narrow, usually pedunculate spike. A similar pattern of variation separates *D. compacta* into a commoner, more western var. **pubescens** (Gray) Barneby, with spikes raised well beyond the linear foliage, from the rarer, more eastern var. **compacta** in which the ampler leaves are developed the length of the stem and are associated with longer stipules and long-tailed interfloral bracts. — Inflorescences and detached cauline leaves × 1; the rest × 5.

D. purpurea var. *purpurea*: 1) top of stem of tall virgate type, with detached leaves of dwarf western forms, one densely gray-silky; 2) bracts, ventral view; 3) flower; 4) calyx with externally glabrescent teeth, a variant common in Missouri; 5) calyx, laid open; 6) petals, all from different plants, the banners in ventral view; 7) androecium, from abaxial side.

D. purpurea var. *arenicola*: 1a) spike at early anthesis.

D. compacta var. *pubescens*: 1) top of stem; 2) flower + bract, with same bract in dorsal view; 3) calyx, laid open; 4) fruiting calyx; 5) pod, profile and vertical views.

D. compacta var. *compacta*: 6) top of stem; 7) flower + bract; 8) petals.

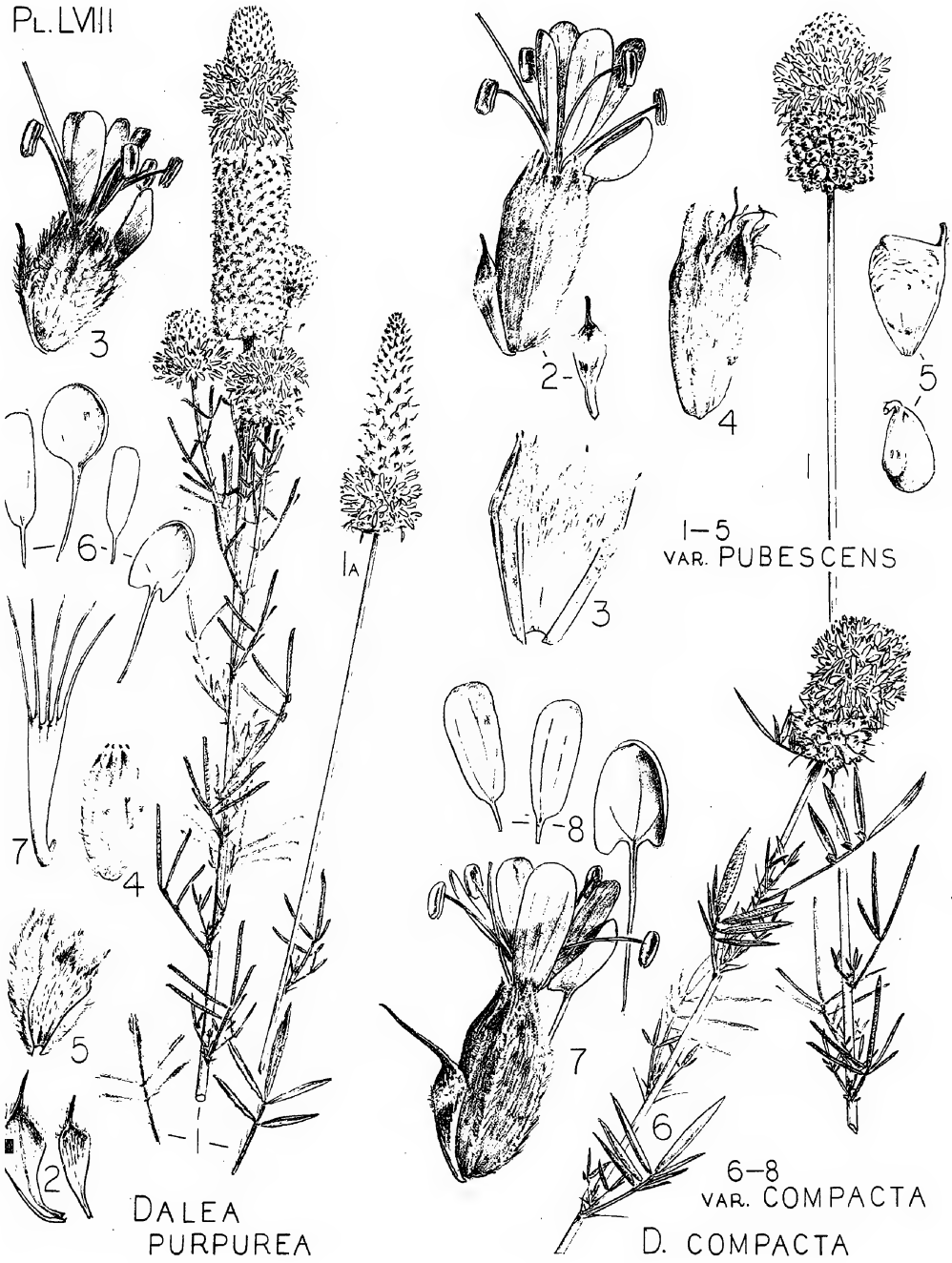

PL. LVIII
3
6
1A
2
4
1
5
1–5
VAR. PUBESCENS
3
7
4
5
2
1
8
7
6
6–8
VAR. COMPACTA
DALEA
PURPUREA
D. COMPACTA

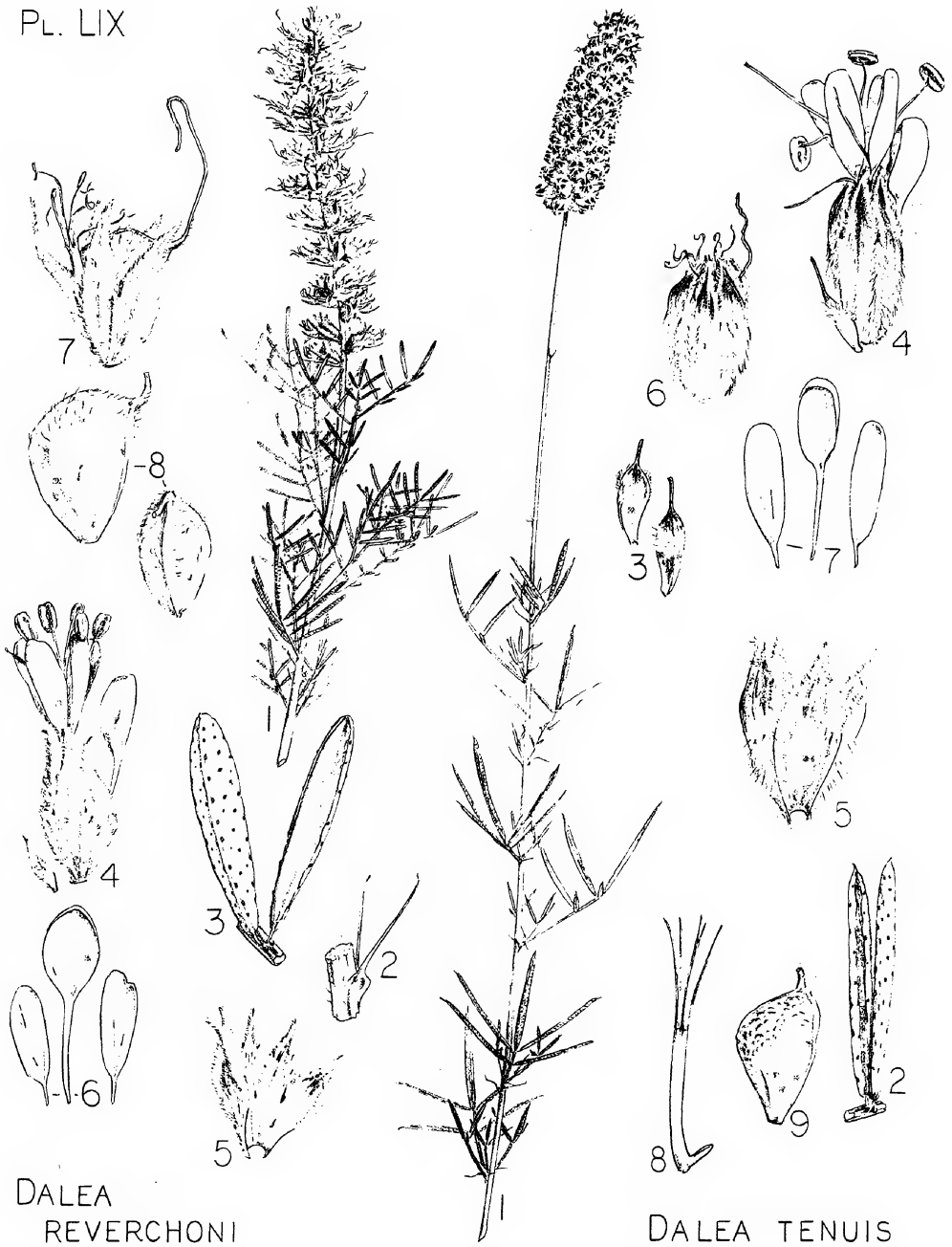
PLATE LIX

Dalea reverchoni (Watson) Shinners and **D. tenuis** (Coulter) Shinners, small prairie-clovers endemic to limestone hill and plateau country in centr. and w.-centr. Texas. Both have green glabrous or inconspicuously pilosulous, prominently dotted foliage contrasting with silvery calyces and vivid magenta- or rose-purple flowers opening in early summer, rarely again in fall. The seldom collected *D. reverchoni*, known from only two stations within a radius of 60 km w. and s.-w. of Fort Worth, is about 2 dm tall and has primary cauline leaves of seven or nine leaflets; the subsessile spike becomes loose in age, and the deeply cleft calyx is tomentulose all over with antrorsely subappressed and entangled hairs. The more widely dispersed *D. tenuis*, which extends outward from a center of abundance on Edwards Plateau n. nearly to Red River and s. to Balcones Escarpment, is up to 4–5 dm tall and has primary leaves of either three or five leaflets; the pedunculate spike is permanently condensed and conelike and the calyx has teeth dorsally glabrate but margined with a fringe of antrorse hairs while the tube is silvery-pubescent, at least on the five bluntly prominent angles, with sharply deflexed hairs. — Habit × 1; the rest × 5.

D. reverchoni: 1) top of fruiting stem; 2) stipules; 3) leaflets; 4) flower at early anthesis; 5) calyx, laid open; 6) petals, the banner (center) in ventral view; 7) fruiting calyx; 8) pod, profile and seen from above.

D. tenuis: 1) top of fruiting stem; 2) leaflets; 3) bract, ventral and dorsal views; 4) flower at late anthesis; 5) calyx of same, laid open; 6) fruiting calyx; 7) petals, the banner, center, in ventral view; 8) androecium; 9) pod.

PL. LIX



DALEA REVERCHONI

DALEA TENUIS

PLATE LX

Dalea tenuifolia (Gray) Shinners and **D. gattingeri** (A. Heller) Barneby, slender diffuse perennial herbs with green foliage and, from late spring into summer, tassels of vivid magenta-purple flowers. Features common to both are a spike never extremely dense or conelike, and ovoid calyces with pale, deeply but symmetrically cleft tube contrasting with green-tipped teeth, the whole hairy outside from base upward, in *D. tenuifolia* with long weak hairs, in *D. gattingeri* with shorter ones, silvery-pilosulous. The leaves of *D. tenuifolia*, a prairie-clover common on the high plains from w. Kansas w. and s. to centr. New Mexico and w. Texas, may be either glabrous or thinly hairy, but the base of each stem is always densely pilose and the interfloral bracts are broad and papery. Stems and leaves of *D. gattingeri*, local in calcareous glades and barrens of centr. Tennessee to adjoining Georgia and Alabama, are at least remotely pubescent distally but glabrous near the rootstock, and the interfloral bracts are firmer and caudate. All flowers in the spike of *D. gattinegri* open in rapid succession, forming a long colorful club-shaped or headlike tassel at full anthesis whereas those of *D. tenuifolia* mature in a more gradual series, a band of color moving slowly up the more pointed spike over a period of several days. — Stems and inflorescences × 1; the rest × 1.

D. tenuifolia: 1) base and summit of same stem, pilose below, glabrate upward; 2) leaflets, hairless; 3) do., pilose; 4) bracts, all ventral view; 5) flower at early anthesis; 6) do., shortly after anthesis; 7) calyx, laid open; 8) petals, the banner ventral view; 9) pod.

D. gattingeri: 1) tip of flowering stem; 2) stipules; 3) leaflets, more and less involute; 4) bracts, profile view; 5) flower; 6) calyx, laid open; 7) fruiting calyx; 8) petals, banner ventral view; 9) androecium.

PL. LX

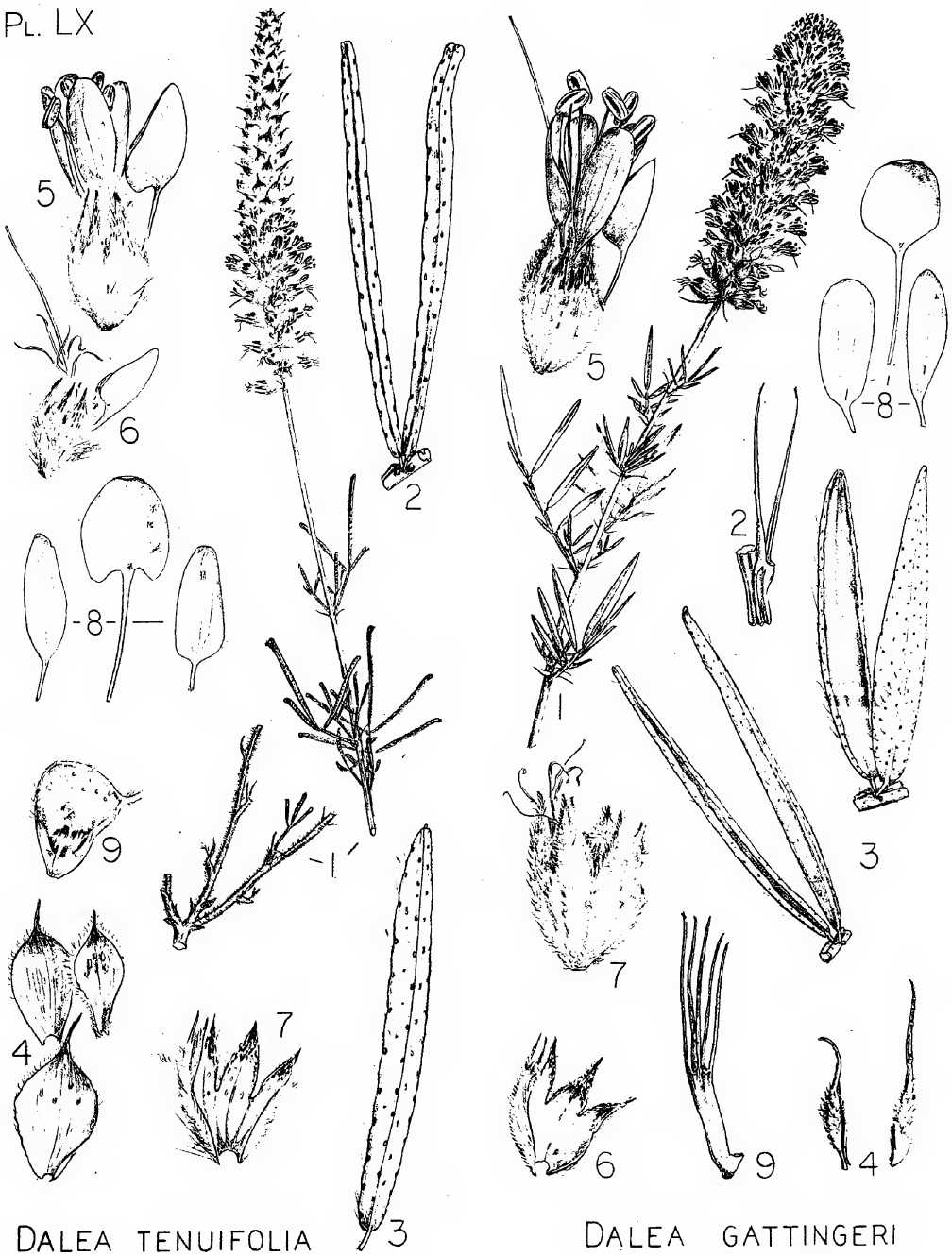


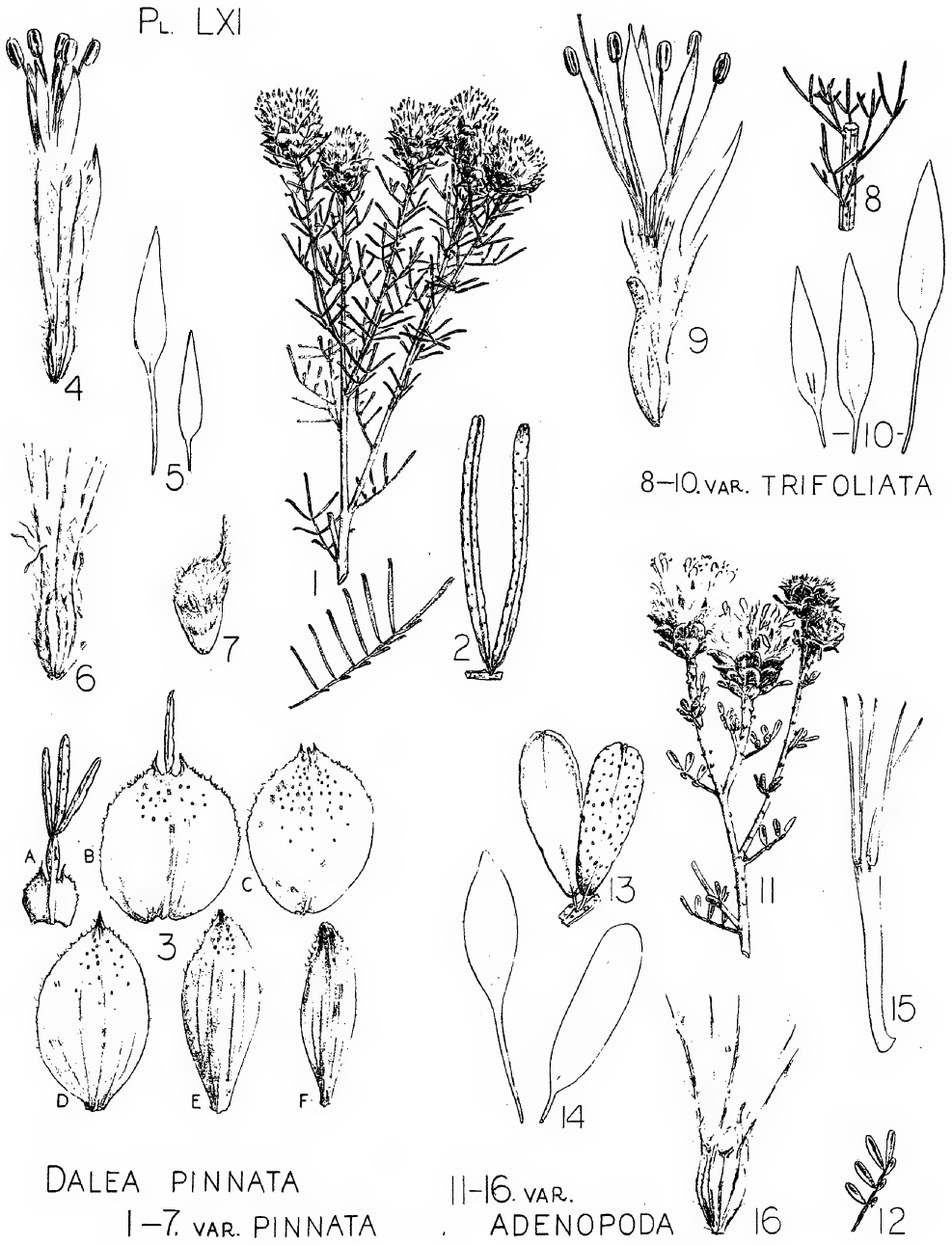
PLATE LXI

Dalea pinnata (J. F. Gmelin) Barneby, tall glabrous herbs widespread in dry sandy habitats over the Atlantic and Gulf Coastal plains of s.-e. United States, with densely but finely leafy, virgate stems branching distally into a corymbose panicle of heads, the small white pentandrous flowers opening in fall and winter. The species is uniquely modified to resemble some eupatorioid Compositae, the spike condensed into a short cone cupped within an involucre composed of enlarged castaneous leaf-bases and bracts of similar texture, while the setiform calyx-teeth function as a pappus, carrying aloft the pod and its single seed in the shape of a little feathered shuttle-cock. Three geographic varieties of *D. pinnata* are: a northeasterly var. **pinnata**, extending from centr. peninsular Florida to South Carolina, with pinnate primary leaves, subfiliform leaflets, and small acutish petals; var. **trifoliata** (Chapman) Barneby, of interior lowland Georgia w. on the Gulf Plain to Mississippi, like var. *pinnata* except for all leaves trifoliolate and slightly larger petals; and var. **adenopoda** (Rydberg) Barneby, of centr. and s. peninsular Florida, differing in its broader leaflets, thicker heads, wider and more obtuse petals, and grossly glandular upper stem. — Branchlets and detached cauline leaves × 1; the rest × 5.

var. *pinnata*: 1) a division of the panicle and a primary cauline leaf from mid-stem; 2) leaflets; 3) involucral bracts, a and b outermost, obviously modified leaf-bases, c the first rank subtending a flower and transitional to d, e, and f, the true interfloral bracts, all dorsal view; 4) flower; 5) banner and epistemonous petal; 6) fruiting calyx; 7) pod.

var. *trifoliata*: 8) part of mid-stem, showing primary and fascicled leaves; 9) flower at anthesis; 10) petals.

var. *adenopoda*: 11) a division of the panicle; 12) primary leaf from mid-stem; 13) leaflets; 14) petals; 15) androecium; 16) fruiting calyx.


PL. LXI
1
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A
B
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D
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F
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9
10
8–10. VAR. TRIFOLIATA
11
12
13
14
15
16
DALEA PINNATA
1–7. VAR. PINNATA
11–16. VAR.
ADENOPODA

PLATE LXII

Dalea lanata Sprengel, a diffusely branching herb widely dispersed on dunes and river sands over the plains from w. Kansas to the coastal prairie of s. Texas, w. into s.-e. Utah, and s. through Rio Grande valley into n. Chihuahua. Leaves and stems are usually gray-villosulous, rarely green, exceptionally glabrous. The vivid magenta purple petals are fugacious, the small epistemonous ones falling from a perch high on the long-exserted androecium within a few hours of expansion. Note the exposed filaments, nine in number, the curious peltate banner, and free keel-petals, characteristic of monotypic sect. *Elaspora*. The species is geographically differentiated into an eastern and southeastern var. **lanata**, with externally villosulous, long-toothed calyx, and a western var. **terminalis** (Jones) Barneby, native along Rio Grande upstream from the Big Bend and w. into Chihuahua and the margins of Colorado Plateau, with externally glabrescent, broadly short-toothed calyx. — Habit × 1; the rest × 5.

var. *lanata*: 1) top of flowering stem; 2) stipules; 3) leaflets; 4) bract, ventral view; 5) flower + bract, lateral view; 6) do., seen from behind banner; 7) calyx; 8) banner, profile and ventral views; 9) wing; 10) keel-petal; 11) androecium; 12) pod.

var. *terminalis*: 7a) calyx; 7b) do., a glabrous forma.

PL. LXII
5
6
7
4
7a
7b
8
9
10
11
12
3
2
1
DALEA LANATA

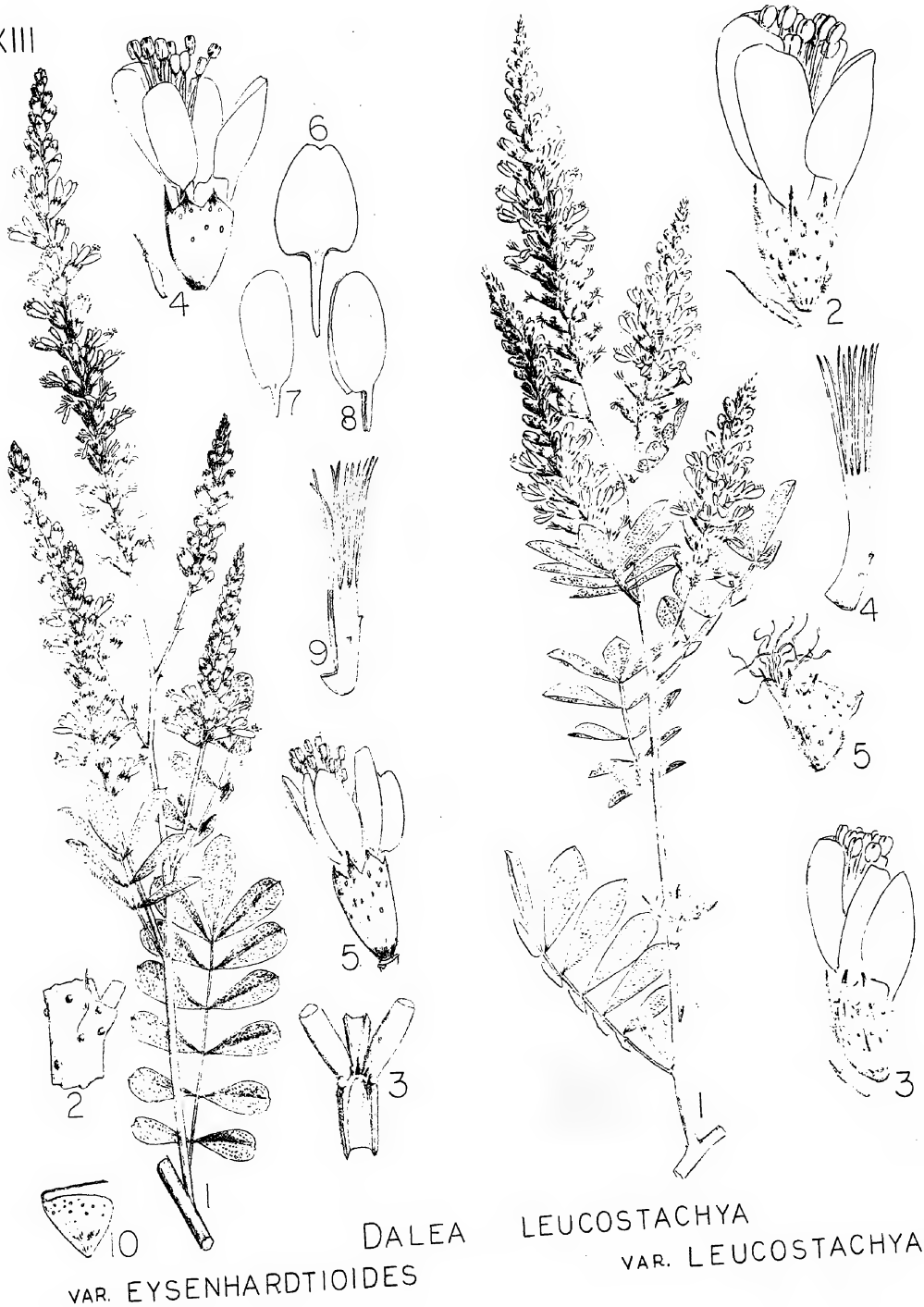
PLATE LXIII

Dalea leucostachya Gray flowers precociously as a weakly suffrutescent herb, but becomes under arid conditions a bush 1–2 m in diameter and in the oak-pine belt of s. Mexico attains the stature of a small tree up to 6 m tall. The foliage varies from green and glabrous to softly and densely gray-tomentulose and the leaflets, which are dotted on both sides, vary from emarginate to shortly acuminate. The flowers, arranged in loose, catkinlike spikes, are pure white with exposed golden-yellow anthers. The species is distributed discontinuously through the Sierras Madre Occidental and Sur from s. Sonora and s.-centr. Chihuahua to Oaxaca, extending inland along the Neovolcanic Belt from Nayarit to the foothills of Nevado de Toluca in s. México, and n. of Río Grande de Santiago crosses the Sierra crest to the edge of the plateau grasslands. Under arid conditions the plants flower in fall months, but continue through winter southward. The var. **leucostachya**, found in Jalisco n.-ward, is the more xerophytic, more densely pubescent, and larger-flowered type; the main cauline leaves commonly subtend densely tomentulose short-shoots which develop as the flowers fade. The poorly differentiated var. **eysenhardtioides** (Hemsl.) Barneby, ranging s. and e. from Jalisco (but apparently disjunct in s.e. Chihuahua) is relatively mesophytic, glabrous, and small-flowered. Its panicle of spikes tends to be less leafy, and there are no tomentulose short-shoots during the winter months. — Inflorescences × 1; leaf-rachis and petiolules × 10; the rest × 5.

var. *leucostachya*: 1) flowering branchlet; 2, 3) flowers + bracts; 4) androecium; 5) fruiting calyx.

var. *eysenhardtioides*: 1) flowering branchlet; 2) stipules; 3) leaf-rachis + petiolules; 4) flower + bract; 5) flower, abaxial view; 6) banner, ventral view; 7) wing; 8) keel; 9) androecium; 10) pod.

LXIII



DALEA LEUCOSTACHYA VAR. EYSENHARDTIOIDES

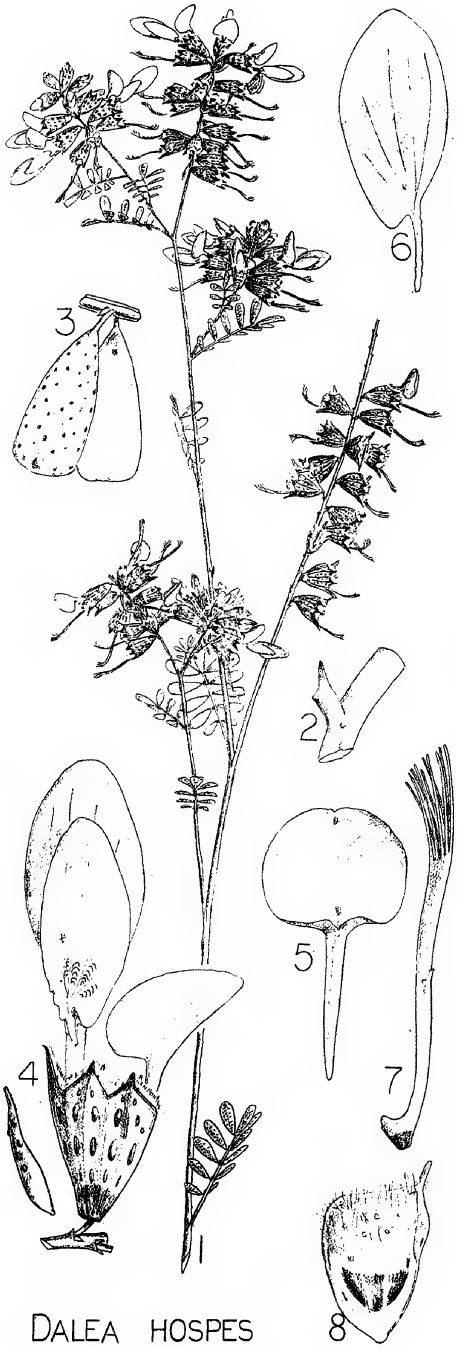
DALEA LEUCOSTACHYA VAR. LEUCOSTACHYA

PLATE LXIV

Dalea frutescens Gray and **D. hospes** (Rose) Bullock are both glabrous shrubs, and alike in the short-toothed calyx which is shiny and (almost always) hairless without but densely silky around the mouth. The low, intricately branched *D. frutescens* only rarely attains a stature of 1 m; the flower is sessile and the petals are bicolored, the banner opening white in contrast to the rose-purple wings and keel. This pretty and floriferous dalea is common over much of mountainous Coahuila and of the Edwards Plateau in Texas, extending north to the Arbuckle Mountains in Oklahoma, west through trans-Pecos to the White Mountains in New Mexico and to eastern Chihuahua, and south just into Nuevo León. The much taller *D. hospes* reaches when fully grown a stature of 1.5–3 m, forming slender, erect, even arborescent shrubs commonly with a single trunk branching into a thin crown of pliant branchlets. Its flower is pedicelled, and the petals open pale greenish-yellow, at least the banner and sometimes all fading brown or reddish. Strongly calciphile, *D. hospes* is endemic to the northern Sierra Madre Oriental; it is common in Nuevo León but extends only shortly north and east into Coahuila and Tamaulipas. — Inflorescences × 1; the rest × 5.

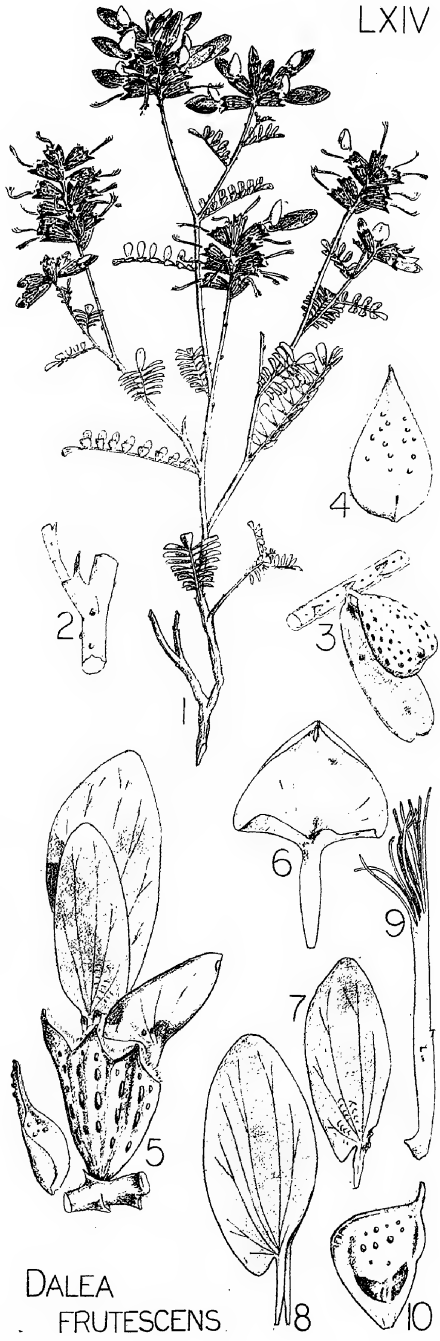
D. frutescens: 1) flowering branchlet; 2) stipules; 3) leaflets; 4) bract, dorsal view; 5) flower + bract; 6) banner, ventral view; 7) wing; 8) keel; 9) androecium; 10) pod.

D. hospes: 1) flowering branchlet; 2) stipules; 3) leaflets; 4) flower + bract; 5) banner, ventral view; 6) keel; 7) androecium; 8) pod.



DALEA HOSPES

LXIV



DALEA FRUTESCENS

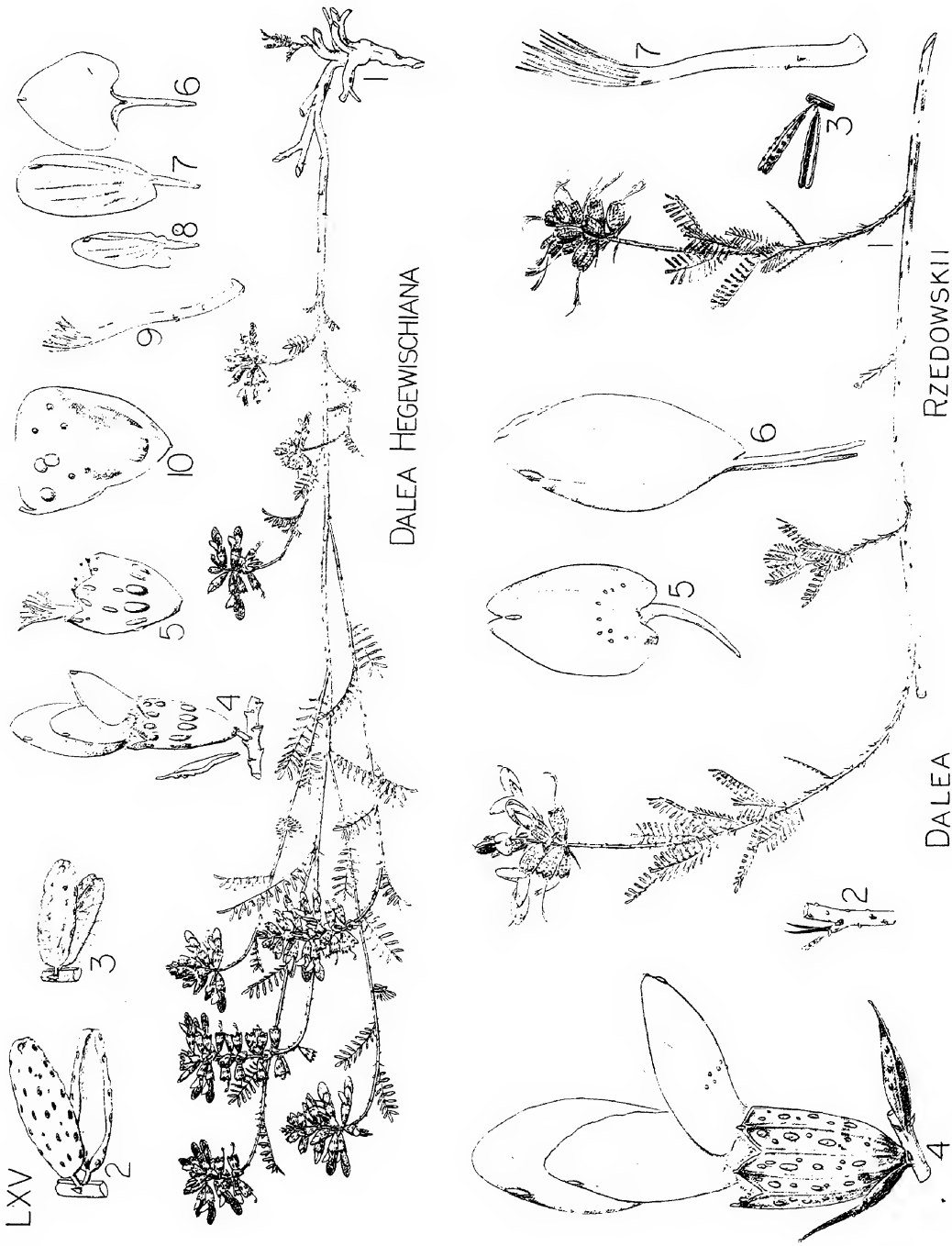

LXV
DALEA HEGEWISCHIANA
DALEA RZEDOWSKII

PLATE LXV

Dalea rzedowski Barneby and **D. hegewischiana** Steud. are prostrate, sometimes feebly suffrutescent, perennial herbs of s.-e. Mexico, alike in having lustrous bell-shaped and very short-toothed calyces glabrous except for the silky-ciliolate orifice and charged externally with shining golden or livid blister-glands. Both have green or glaucescent foliage and bicolored flowers, the banner opening whitish, the inner petals rose- or ruby-purple, all tipped with a prominent gland. The rare *D. rzedowskii*, found only once, flowering in October, in the Sierra Madre Oriental in s.-e. San Luis Potosí, is glabrous up to the mouth of the calyx, and has relatively few, large, sessile flowers subtended by persistent bracts. The range of *D. hegewischiana*, which has been found in flower in spring, summer, autumn, and winter, extends at ± 1500–2400 m from s. Hidalgo and adjoining México (Edo. and Distrito Federal) s.-e. through Puebla to the vale of Oaxaca. The flowers are relatively small and numerous, shortly pedicelled, and lose the subtending bract as the bud reaches anthesis. The plant varies from quite glabrous to thinly pilosulous, especially on the young branchlets and, late in the season, on innovations arising near the root-stock. Note the few large glands in each interval of the calyx, arranged by 1–3 in vertical ranks, contrasted with the many scattered glands of *D. rzedowskii*. — Habit × 1; pod of *D. hegewischiana* × 10; the rest × 5.

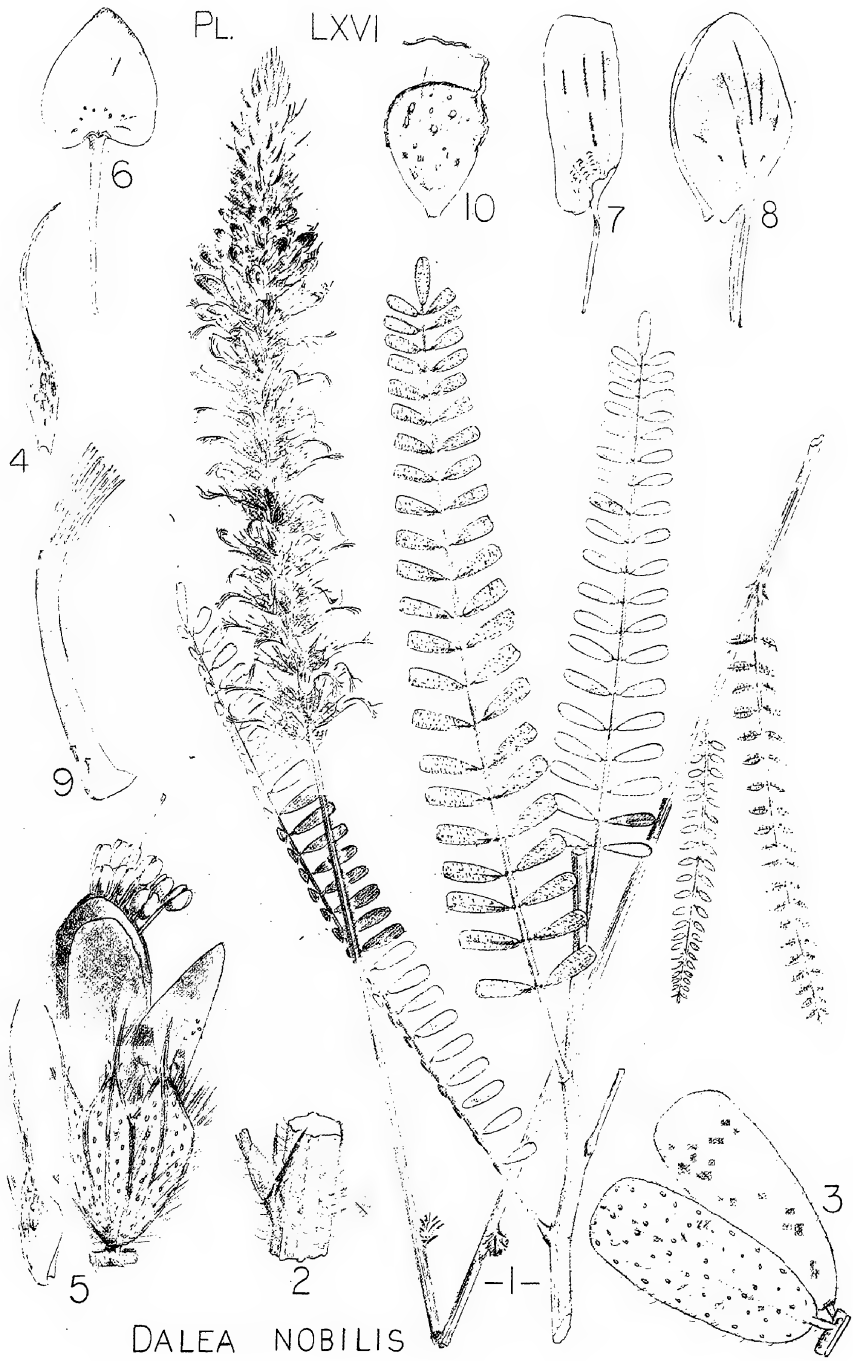
D. rzedowskii: 1) part of stem, showing 2 lateral branchlets in flower; 2) stipules; 3) leaflets; 4) flower + bracts; 5) banner, ventral view; 6) keel; 7) androecium.

D. hegewischiana: 1) habit; 2) leaflets of main cauline leaf; 3) leaflets from basal innovation; 4) flower + bract; 5) fruiting calyx; 6) banner, ventral view; 7) wing; 8) keel; 9) androecium; 10) pod.

PLATE LXVI

Dalea nobilis Barneby, a handsome, winter-flowering species with virgate stems up to a meter tall, is known only from the type-locality, in oakwoods on a northern affluent of Río Grande de Santiago in the southern prong of Zacatecas. It resembles *D. polystachya* (Plate LXVII), but is finely pilosulous throughout and the anthers are exserted at full anthesis from between the relatively short keel-petals. The flowers are homochromous, of a uniform purple — Spike and leaves × 1; the rest × 5.

1) spike + part of main stem and cauline leaves; 2) stipules; 3) leaflets; 4) bract, ventral view; 5) flower + bract; 6) banner, ventral view; 7) wing; 8) keel; 9) androecium; 10) pod.


PL. LXVI
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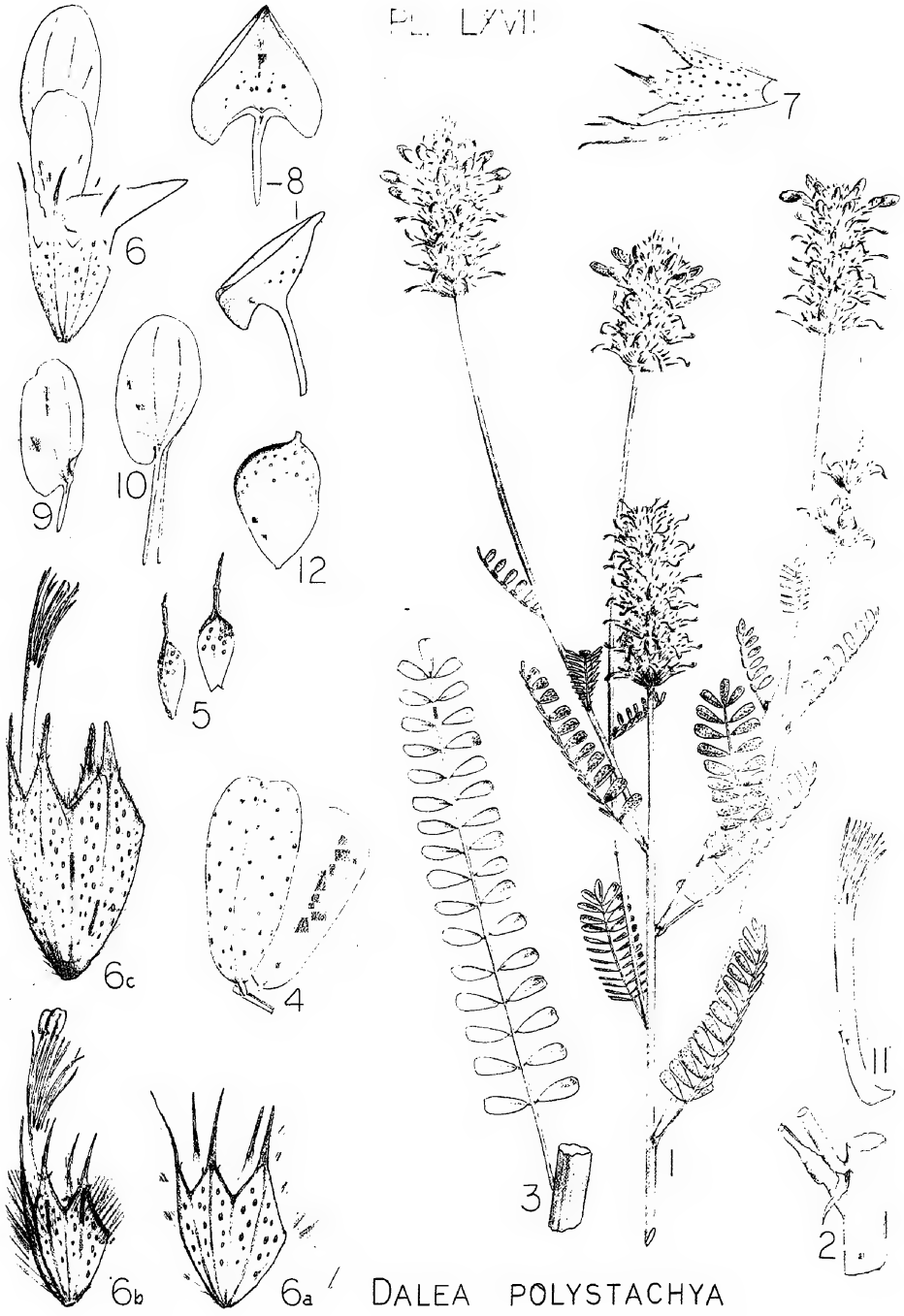
DALEA NOBILIS

PLATE LXVII

Dalea polystachya (Sessé & Mociño) Barneby, a weakly suffrutescent dalea up to 8–18 dm tall, glabrous except for the inflorescence and a few villosulous basal shoots developing in the dry season, notable for its numerous plane leaflets, multiglandular calyx, and blue or rose-purple flowers produced in fall and winter. The species is widely but discontinuously dispersed in Mexico, along the Transverse Volcanic range w.-ward from s. México to the Pacific and along the Sierras Madre Occidental and Sur from centr. Durango to Oaxaca, the scattered populations differing among themselves in color of the petals and in size and relative proportions of the calyx. — Habit and detached cauline leaf × 1; the rest × 5.

1) branch of panicle; 2) stipules; 3) primary cauline leaf; 4) leaflets; 5) interfloral bracts, dorsal and ventral view; 6) flower; 6a, 6b) calyces; 6c) calyx + androecium from type-collection of *Parosela lagopina* (see accompanying text); 7) calyx laid open; 8) banner, ventral and profile views; 9) wings; 10) keel; 11) androecium; 12) pod.



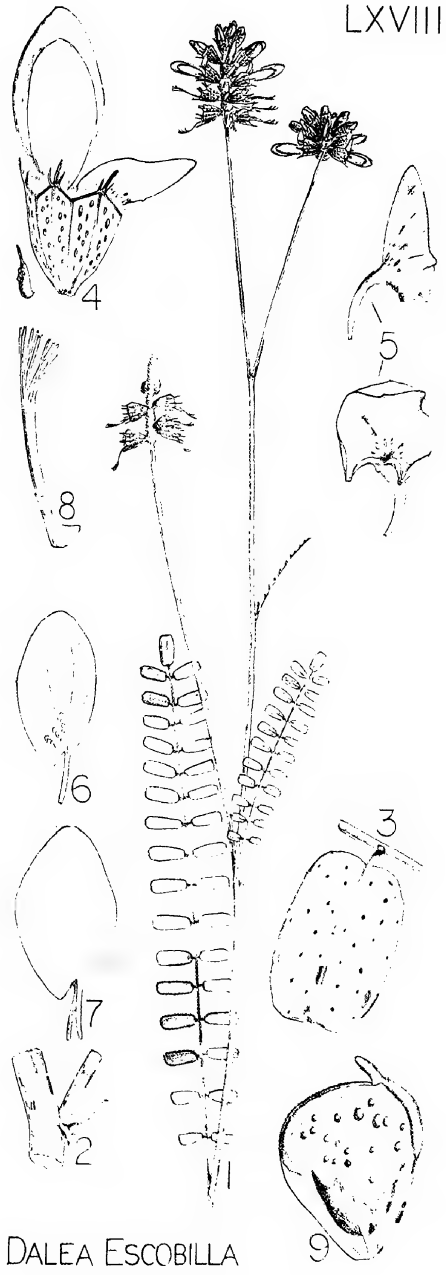
DALEA POLYSTACHYA

PLATE LXVIII

Dalea nemaphyllidia Barneby and **D. escobilla** Barneby, herbaceous or weakly suffrutescent herbs, glabrous up to the flower-spikes, with smooth, virgate stems up to a meter tall branching distally into an open panicle. Each is known from a single locality in the oak-pine belt at ± 1000–1200 m in Nayarit, *D. escobilla* from Cerro de San Juan near Tepic, *D. nemaphyllidia* from Yxtlán. The flowers, appearing in the fall and winter months, are similarly bicolored, the banner whitish or largely so, finally rubescent, the inner petals rose-purple. The short-toothed calyx, externally glabrous but fringed about the mouth with silky hairs, distinguishes *D. escobilla* from closely related *D. polystachya* (Pl. LXVII) and the many leaflets from *D. mcvaughii* (Pl. LXIX). No other Mexican dalea has the long, truly linear-involute, glaucous leaflets of *D. nemaphyllidia*. — Inflorescences, and detached leaf of *D. nemaphyllidia* × 1; pods, and leaf-rachis of *D. nemaphyllidia* × 10; the rest × 5.

D. escobilla: 1) branch of panicle; 2) stipules; 3) leaflet, dorsal view; 4) flower + bract; 5) banner, profile and ventral view; 6) wing; 7) keel; 8) androecium; 9) pod.

D. nemaphyllidia: 1) branch of panicle; 2) primary cauline leaf; 3) segment of leaf-rachis + petiolule; 4) bracts, dorsal and profile views; 5) flower; 6) banner; 7) wing; 8) keel; 9) androecium; 10) pod.



DALEA ESCOBILLA

DALEA NEMAPHYLLICH

PLATE LXIX

Dalea mcvaughii Barneby, a rare species of the oak-pine belt in Jalisco, flowering in fall, has a single tall wandlike stem arising from a thickened woody root, glabrous foliage, and purple flowers. It is related to *D. escobilla* (Pl. LXVIII) and resembles it in the externally glabrous, lustrous calyx fringed around the orifice with silky hairs; but differs in the fewer larger leaflets, denser spikes, and longer bracts and calyx-teeth. — Habit-sketch × ⅙; parts of stem and inflorescence × 1; the rest × 5.

1) a whole plant; 2) part of stem bearing primary cauline leaves + a division of the panicle; 3) flower + bract; 4) banner, ventral and profile views; 5) wing; 6) keel; 7) fruiting calyx; 8) pod.

LXIX
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DALEA
McVAUGHII

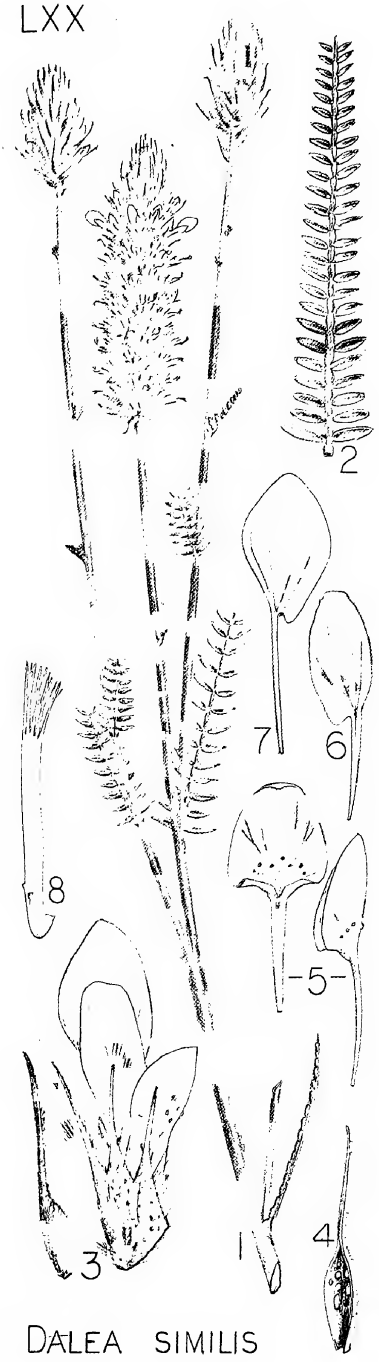
PLATE LXX

Dalea similis Hemsl. and **D. pectinata** Kunth may be recognized by their foliage alone. The imparipinnate, densely pilosulous cauline leaves of *D. similis* are unique in the genus, as are the glabrous, comblike ones of *D. pectinata*. The latter inhabits dry oak-pine woods and open grasslands at about 1500–2500 m, flowering in summer and early fall; it is common in west-central Mexico, mostly north of the Neovolcanic Belt, from Guanajuato to interior Nayarit, north to San Luis Potosí, Aguas Calientes, and central Durango, but not reaching the Pacific slope. The full grown stems, herbaceous or weakly suffruticose, are virgate and densely leafy at and below the middle, sparsely leafy and paniculately branched toward the top, and full grown reach a stature of about 5–13 dm. The petals except for an often partly white (but rubescent) banner are commonly vivid blue or violet, but sometimes lavender. The winter-flowering *D. similis* is an exceptionally robust, virgate dalea, of unknown stature but at least a meter tall, softly gray-tomentulose up to the silky-barbate spikes of small, pale mauve flowers. It is known only from oak-pine forest near 2000 m on the Pacific slope of Sierra Madre Occidental in Sinaloa. Note the large basal pair of leaflets (fig. 2), an unusual feature shared by the sympatric but glabrous *D. pulchella* (Pl. CVII). Inflorescences and main cauline leaves × 1; pod × 10; the rest × 5.

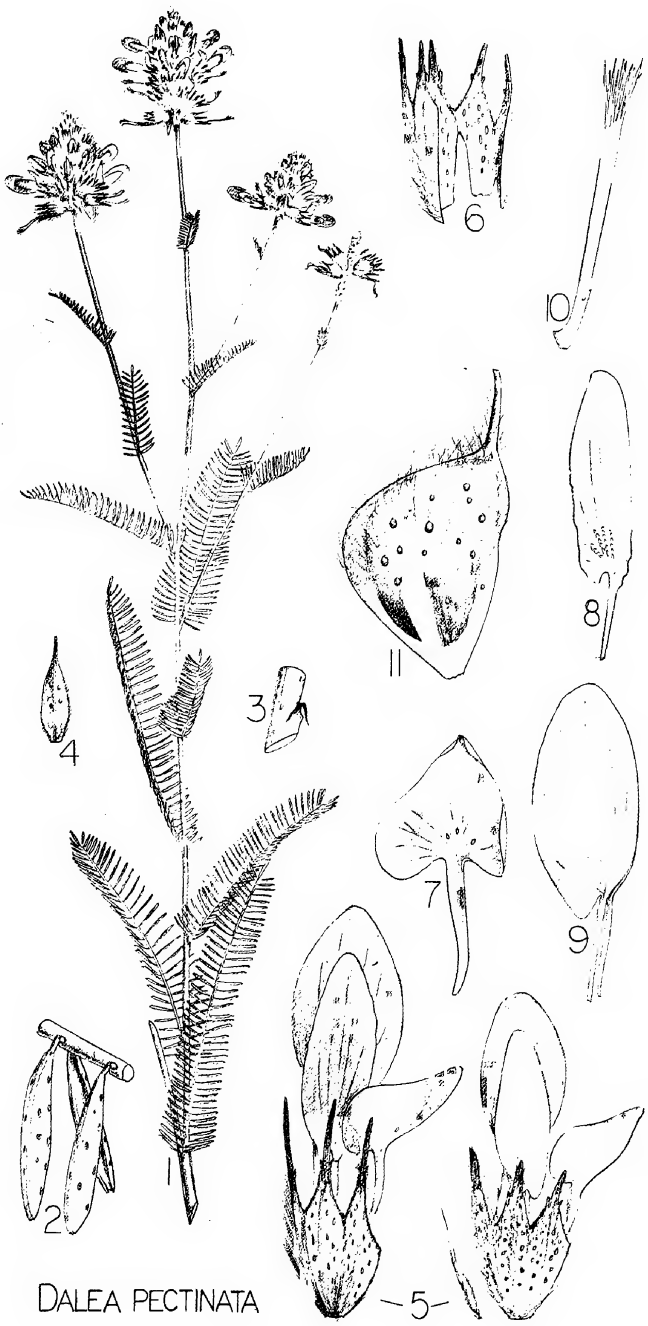
D. similis: 1) branch of panicle; 2) main cauline leaf; 3) flower + bract; 4) bract, ventral view; 5) banner, ventral and lateral views; 6) wing; 7) keel; 8) androecium.

D. pectinata: 1) branch of panicle; 2) leaflets; 3) stipules; 4) lower bract, dorsal view; 5) flower + upper bract; 6) calyx, laid open; 7) banner, ventral view; 8) wing; 9) keel; 10) androecium; 11) pod.

LXX



DALEA SIMILIS



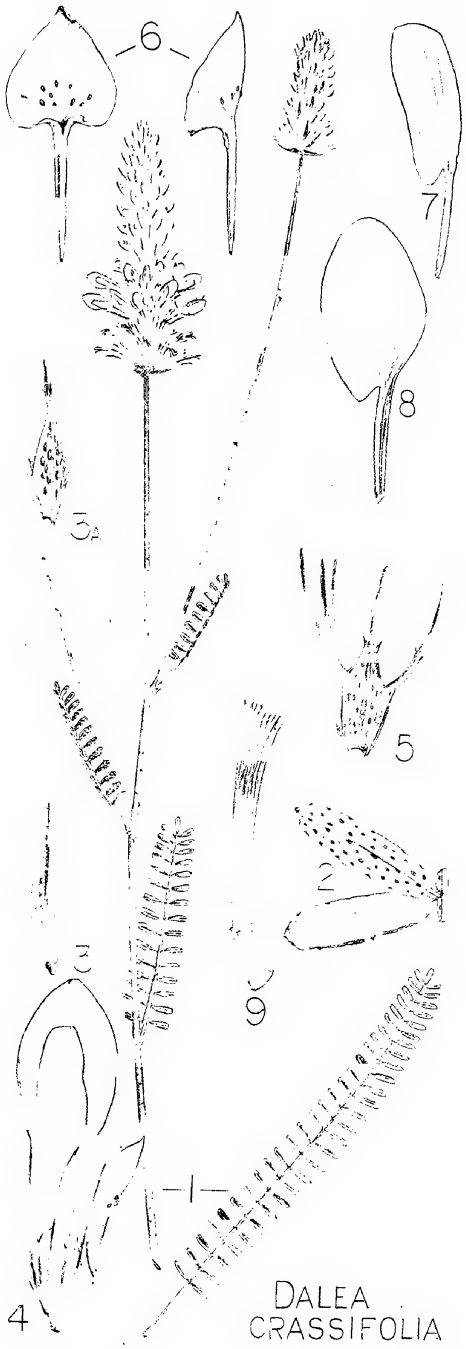
DALEA PECTINATA

PLATE LXXI

Dalea crassifolia Hemsley and **D. abietifolia** (Rose ex Rydberg) Bullock, weakly suffrutescent daleas of w.-centr. Mexico notable for many pairs of leaflets. The tall *D. crassifolia*, with adult stems up to a meter long, has glabrous stems and foliage, boat-shaped leaflets of fleshy texture, and pale lilac or whitish flowers opening in late fall and winter. Its home is in the oak-belt on the Pacific slope in Sinaloa, adjoining Durango, and w. Jalisco. The stems of *D. abietifolia*, like the leaves gray-tomentulose throughout, are seldom half as tall and the crowded leaflets are rolled up into the form of cylindric gutters narrowly open on the upper side; the epistemonous petals are rose-purple. Another highly localized species, *D. abietifolia* is known from scattered stations in the oak-pine belt in centr. Michoacán and Jalisco, sometimes associated with white chalky soils derived from volcanic ash and flowering in the early months of the dry season. — Habit × 1; leaf-rachis of *D. abietifolia* (fig. 3) × 10; the rest × 5.

D. crassifolia: 1) branch of panicle + primary cauline leaf from mid-stem; 2) pair of leaflets; 3, 3a) bracts, from middle of spike, dorsal and ventral views; 4) flower; 5) calyx, laid open; 6) banner, ventral and profile views; 7) wing; 8) keel; 9) androecium.

D. abietifolia: 1) branch of panicle + central part of main stem; 2) stipules; 3) part of leaf-rachis; 4) leaflets; 5) interfloral bract, ventral and dorsal views; 6) flower; 7) calyx, laid open; 8) banner, ventral and profile views; 9) wing; 10) keel; 11) androecium.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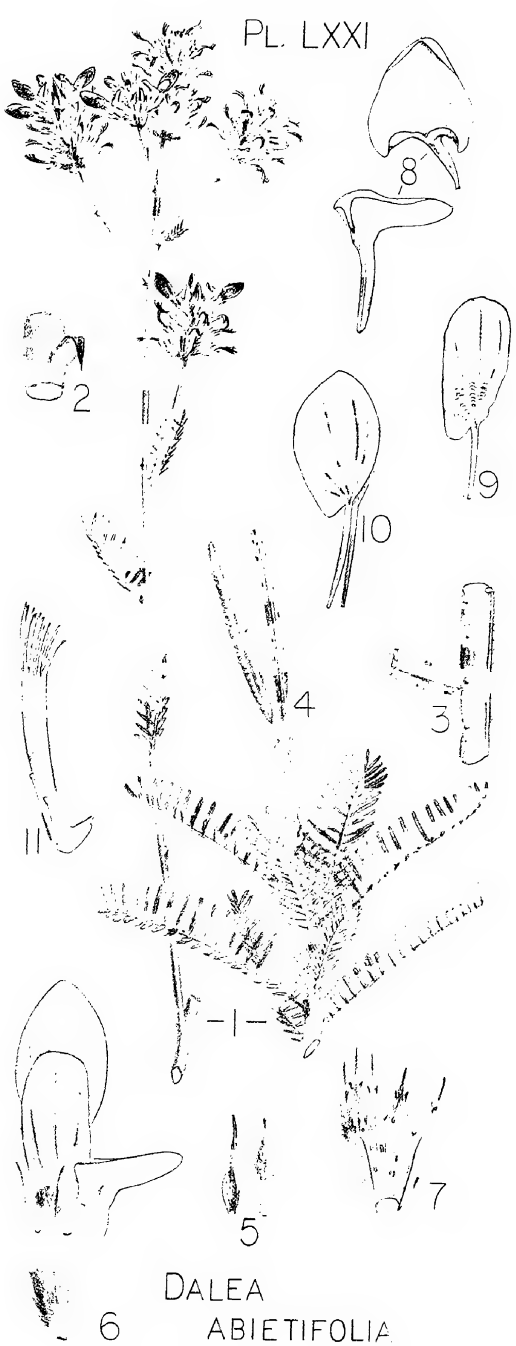
DALEA
CRASSIFOLIA


PL. LXXI
8
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9
10
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3
11
1
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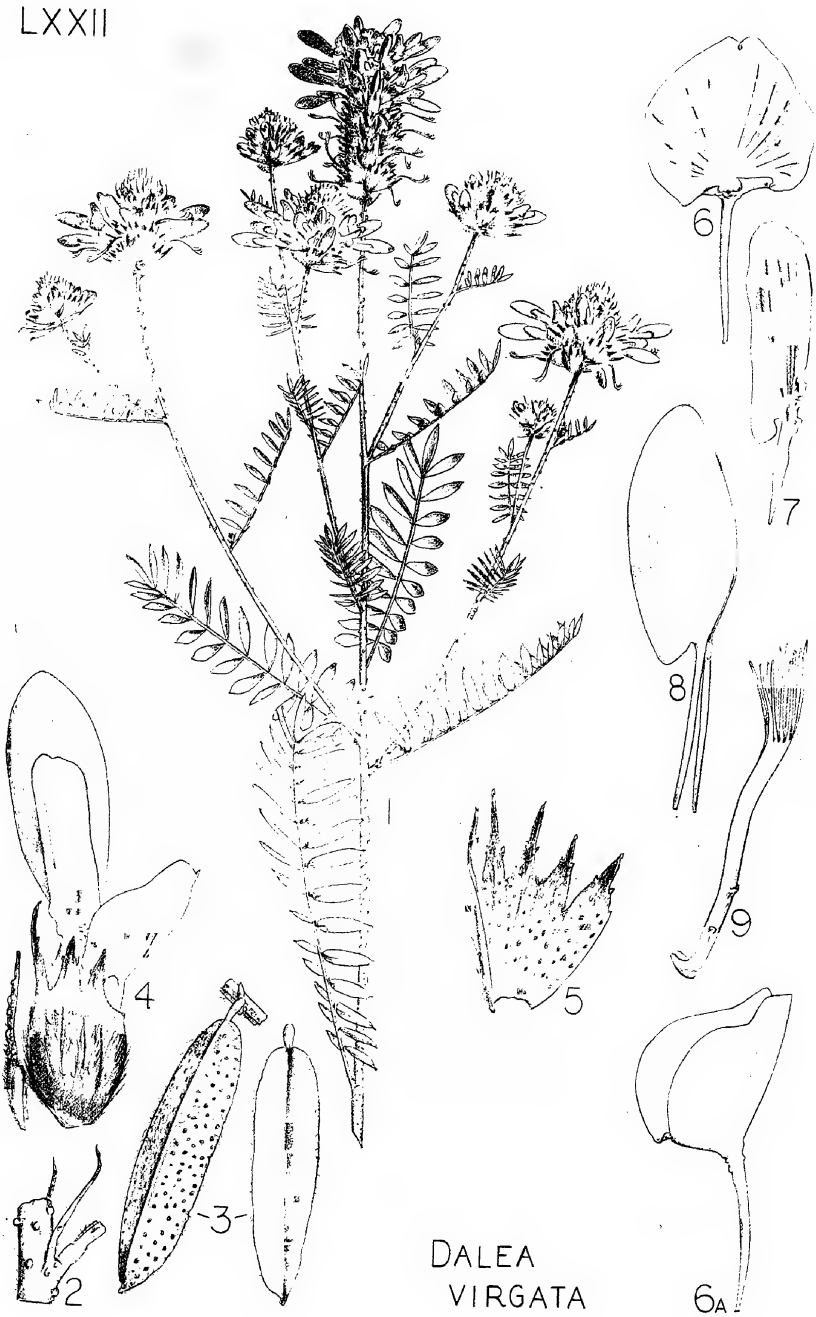
5
6
DALEA
ABIETIFOLIA

PLATE LXXII

Dalea virgata Lag., a handsome, floriferous shrub endemic to sunny oak-pine forest at 1950–2250 m in central Oaxaca, has virgate stems about a meter tall branching into a corymbose panicle of many heads. The green foliage is thinly pilosulous at least beneath, the spikes are dense but not conelike, and the bracts are deciduous and silky inside. The flowers develop in the dry season, starting in October and continuing into early winter; except for a white eye in the banner the petals are concolorous, of lively lilac-purple or pinkish-violet hue. Inflorescence × 1; the rest × 5.

1) top of stem; 2) stipules; 3) leaflets, dorsal and ventral views; 4) flower + bract; 5) calyx, laid open; 6) banner, ventral view; 6a) the same, profile; 7) wing; 8) keel; 9) androecium.


LXXII
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6A
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DALEA
VIRGATA

PLATE LXXIII

Dalea caeciliae Harms and **D. insignis** Hemsl. resemble each other and *D. mutabilis* (Plate LXXIV) in most structural details of the flower and pod, but each in its own way is uniquely modified. Both are rare and local species, known each from two or three scattered localities in Puebla and Oaxaca, where they are confined, so far as known, to limestone bedrock. The erect, suffrutescent *D. caeciliae*, immediately recognized by its densely black-warted stems, is variably but thinly pilose; the flowers are shortly pedicelled and bicolored, the banner opening white and fading purplish in contrast to epistemonous petals that are tipped or suffused with dark but vivid blue. The almost glabrous *D. insignis* is a coarse, amply leafy annual herb up to 8 dm tall. The development of the stipules into foliaceous fins and the bracts into immense, papery-membranous, veiny boats that enclose a small glabrous calyx, has no counterpart in *Dalea*. Inflorescences × 1; the rest × 5, unless where mentioned.

D. caeciliae: 1) summit of flowering stem; 2) part of stem, showing peg-shaped warts, × 10; 3) flower + bracts; 4) banner, ventral view; 5) androecium; 6) pod.

D. insignis: 1) top of stem; 2) leaflet, dorsal view × 2; 3) bract, profile view; 4) flower; 5) banner, ventral view; 6) androecium; 7) pod.

LXXIII
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DALEA CAECILIAE
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6
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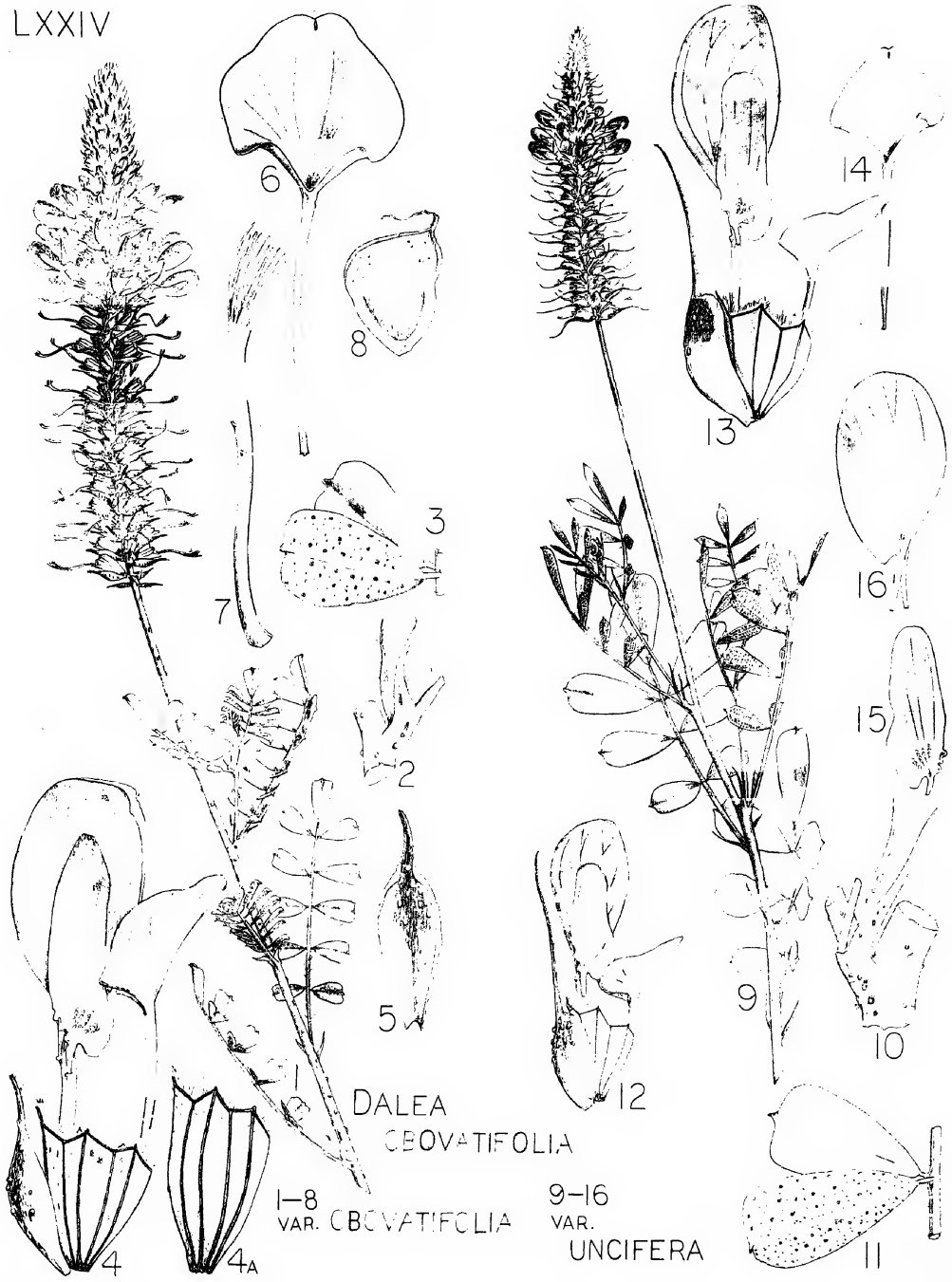
2
4
DALEA INSIGNIS

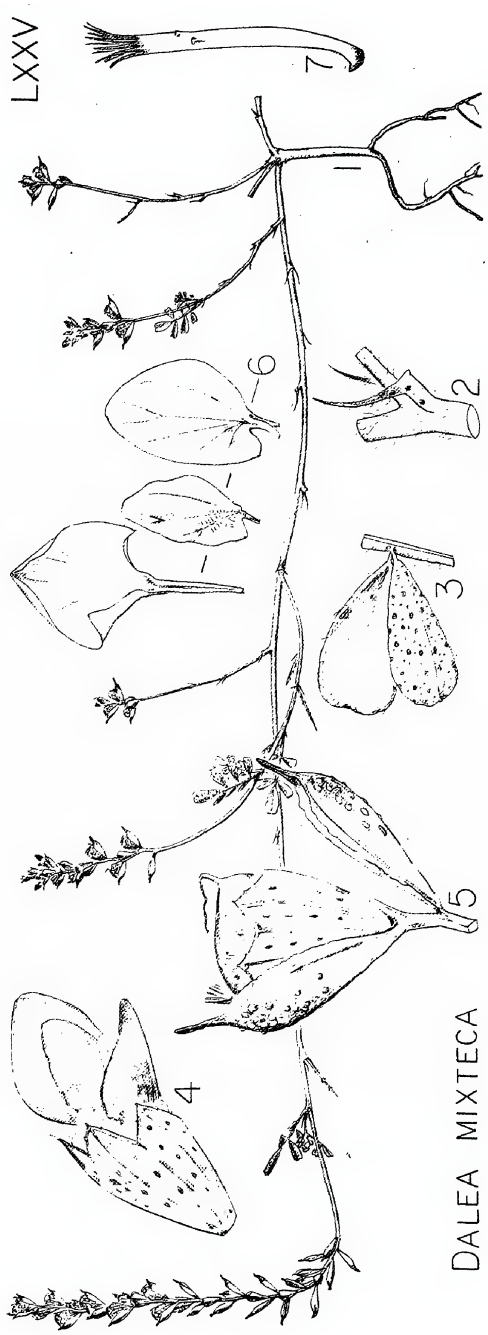
PLATE LXXIV

Dalea obovatifolia Ortega, native to southern Mexico, highland Guatemala, and Honduras, has green foliage, but the stems and leaf-stalks, and often the leaflets also, are thinly pilose with fine, spirally twisted hairs. Persistent, boat-shaped bracts clasp the base of a hyaline calyx which is bell-shaped, divided into glassy panels by filiform livid ribs, and crenately toothed around the silvery-ciliate mouth. The long-clawed banner opens greenish-white but soon turns reddish; the short-clawed inner petals, at full anthesis carried out on a column beyond the calyx, are suffused or tipped with peacock shades of greenish or bronzy violet that fade livid purple. The var. **obovatifolia**, one of the first daleas cultivated in Spain, where it provided Cavanilles with the type of his genus *Parosela*, is probably a derived form representing the species in the high arid valleys and tablelands on the north slope of the Neovolcanic Belt lying between the Nevado de Toluca and Mt. Orizaba and disjunctly, perhaps by parallel adaptation, in the mountains of central Oaxaca. Its distinctive characters are a perennial root, diffuse herbaceous stems, a relatively large flower, a calyx externally pubescent below the orifice, and bracts contracted into a tail shorter than the body. The var. **uncifera** (C. & S.) Barneby is found either at lower elevations or in more sheltered and moister sites than var. *obovatifolia*. It is common in the pine forests of the Neovolcanic Belt from central Michoacán to Veracruz, and has been collected in scattered stations in Guerrero, Oaxaca, Guatemala, and Honduras. The central stem of var. *uncifera* rises erect from an annual root but may be either stout or slender, when fully grown one to twelve decimeters tall, and if active growth continues late into the dry winter season it may become softly woody. Diagnostic features, not always correlated, are a small flower subtended by long-tailed bracts and a calyx glabrous externally but fringed around the mouth. Inflorescences × 1; stipules and leaflets × 3; the rest (except where mentioned) × 5.

var. *obovatifolia*: 1) summit of stem; 2) stipules; 3) leaflets; 4) flower + bract; 4a) another, smaller calyx, at twice the scale of 4; 5) bract, ventral view; 6) banner, ventral view; 7) androecium; 8) pod.

var. *uncifera*: 9) summit of stem; 10) stipules; 11) leaflets; 12) flower + bract; 13) a larger flower; 14) banner, ventral view; 15) wing; 16) keel.


LXXIV
DALEA
OBOVATIFOLIA
1–8
VAR. OBOVATIFOLIA
9–16
VAR.
UNCIFERA


LXXV
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DALEA MIXTECA

PLATE LXXV

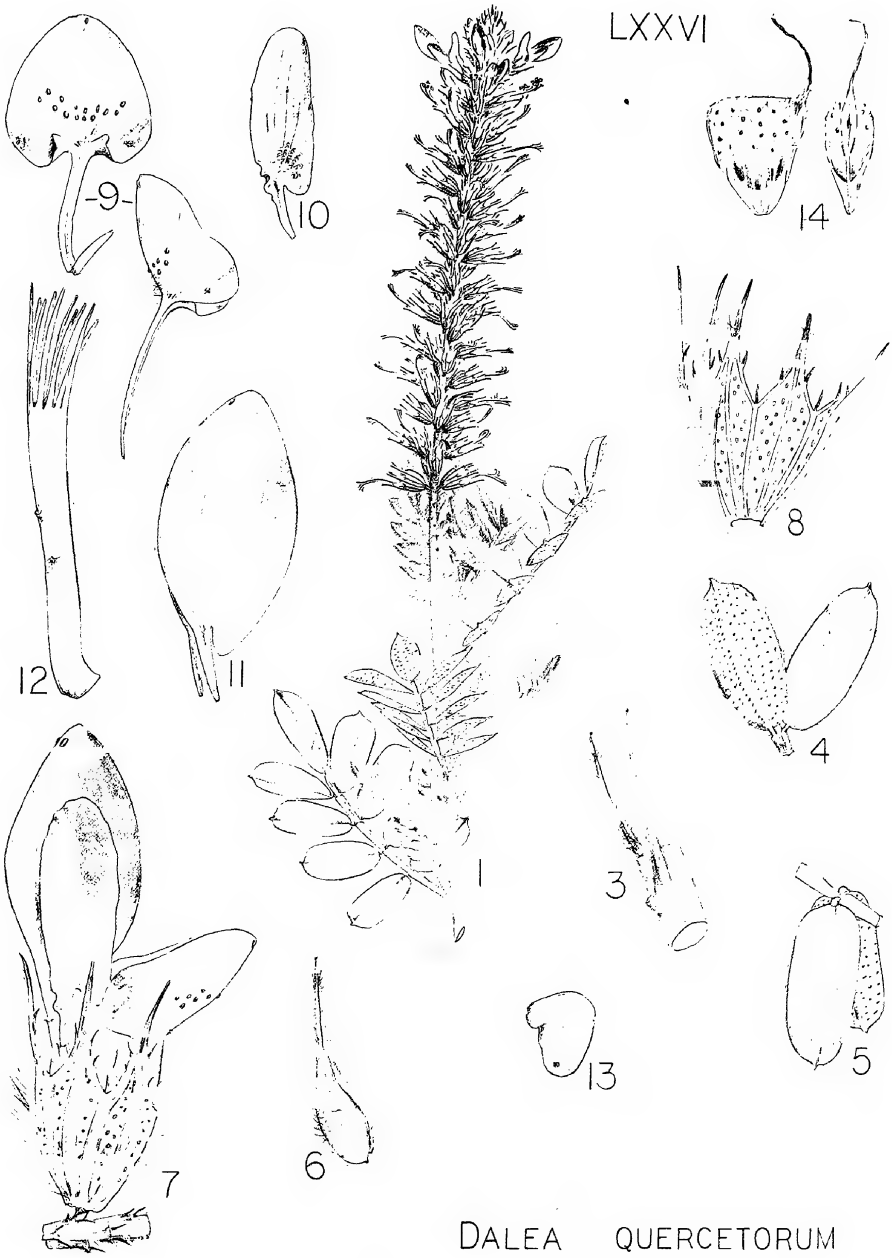
Dalea mixteca Barneby, a highly modified annual herb of limestone hills in central Oaxaca, flowering in fall. It is related to *D. obovatifolia*, but has acquired with a monocarpic life span a tiny inconspicuous flower, probably autogamous. Among Mexican annual daleas *D. mixteca* is notable for its persistent bracts, loose spikes, externally glabrous, short-toothed calyces, and deep plum-purple epistemonous petals perched well above middle of androecium on exceptionally short claws. — Habit × 1; stipules and leaflets × 5; the rest × 10.

1) habit; 2) stipules; 3) leaflets; 4) flower; 5) bracts and fruiting calyx; 6) petals, the banner in ventral view; 7) androecium.

PLATE LXXVI

Dalea quercetorum Standl., a coarsely leafy dalea flowering first as an erect monopodial herb but becoming suffruticose or truly shrubby, sometimes up to 5 m tall. It is found locally in mixed woodland and pine-oak forest in the highlands of Honduras, Guatemala, and Chiapas, in flower in the fall and winter months. The developing foliage and the leaves of axillary branchlets are densely silvery-silky with fine spiral hairs, but the primary cauline leaves become green when adult and are drought-deciduous. The petals of *D. quercetorum* are particolored, white and vivid blue, the blue concentrated along the inner half of the epistemonous petals and the basal lobes of the banner, forming a continuous vertical stripe along the corolla as seen in profile. Notable features of the species are the pedicellate calyx, the long-clawed banner pilosulous dorsally at base of blade, the high-perching keel, and the multiseriate glands in each panel of the calyx. — Flowering branch × 1; detached leaflets × 2; the rest × 5.

1) Flowering branch at late anthesis (flowers of young racemes are more crowded); 3) stipules; 4) leaflets; 5) do., in sleeping posture, back to back; 6) bract; 7) flower; 8) calyx, laid open; 9) banner, ventral and profile views; 10) wing; 11) keel; 12) androecium; 13) seed; 14) pod, profile and adaxial views.


LXXVI
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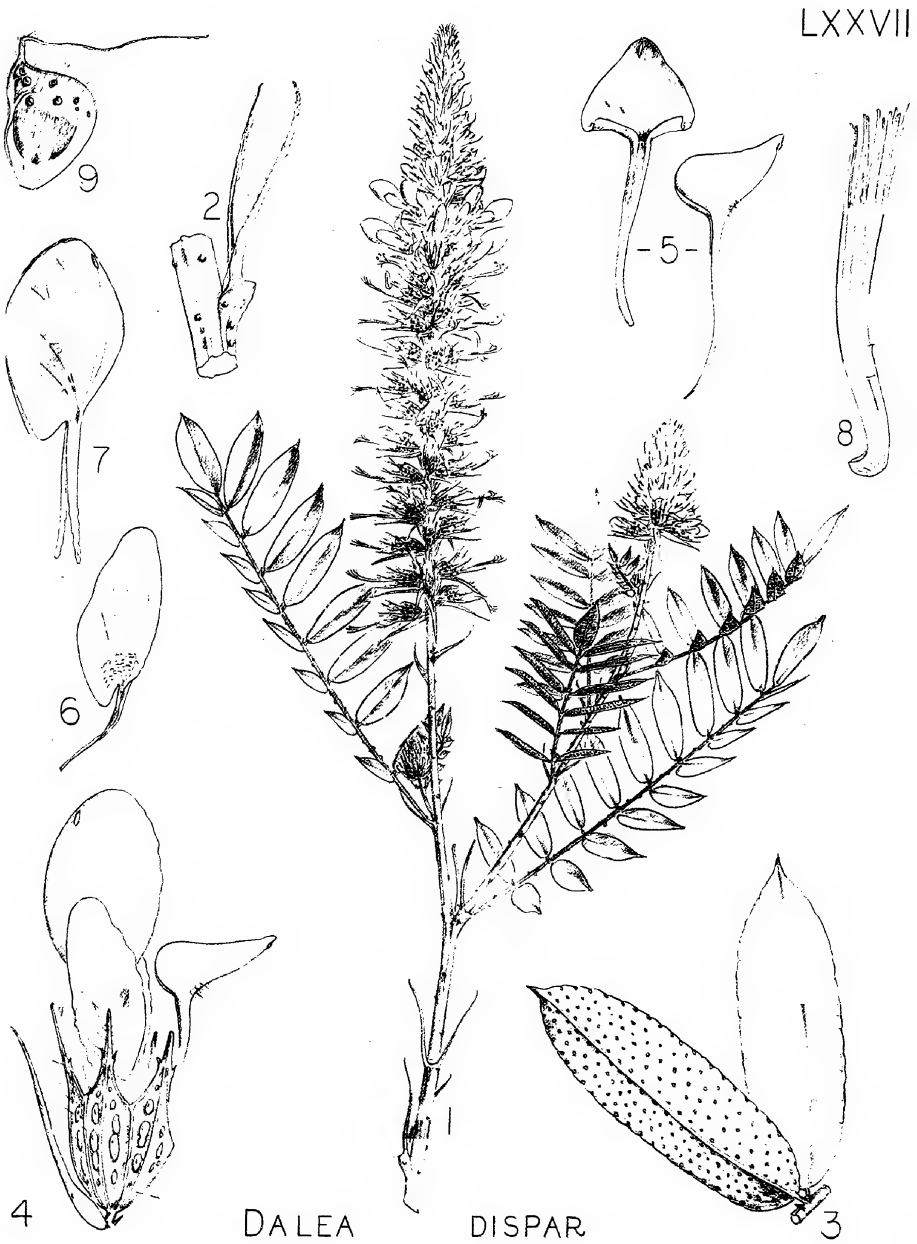
DALEA QUERCETORUM

PLATE LXXVII

Dalea dispar Morton, a tall, amply leafy shrubby herb of open woodland, thickets and hedgerows at middle elevations in the mountains of Guatemala, flowering in late fall and winter. Although fertile in its first year of growth, the adult plant can form a bush up to 2 m tall. Notable features of *D. dispar*, a species without close known relatives, are the almost glabrous, dorsally dotted leaflets, elongate stipules, long and narrow, persistent bracts of papery texture, coarsely gland-tuberculate calyces, yellowish petals that commonly turn brownish-rose in fading, and especially the long-clawed banner bearing on back of the blade a little tuft of fine spiral hairs. — Flowering branchlet × 1; the rest × 5.

1) flowering branchlet; 2) stipules; 3) leaflets; 4) flower + bract; 5) banner, ventral and profile views; 6) wing; 7) keel; 8) androecium; 9) pod.


LXXVII
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DALEA DISPAR

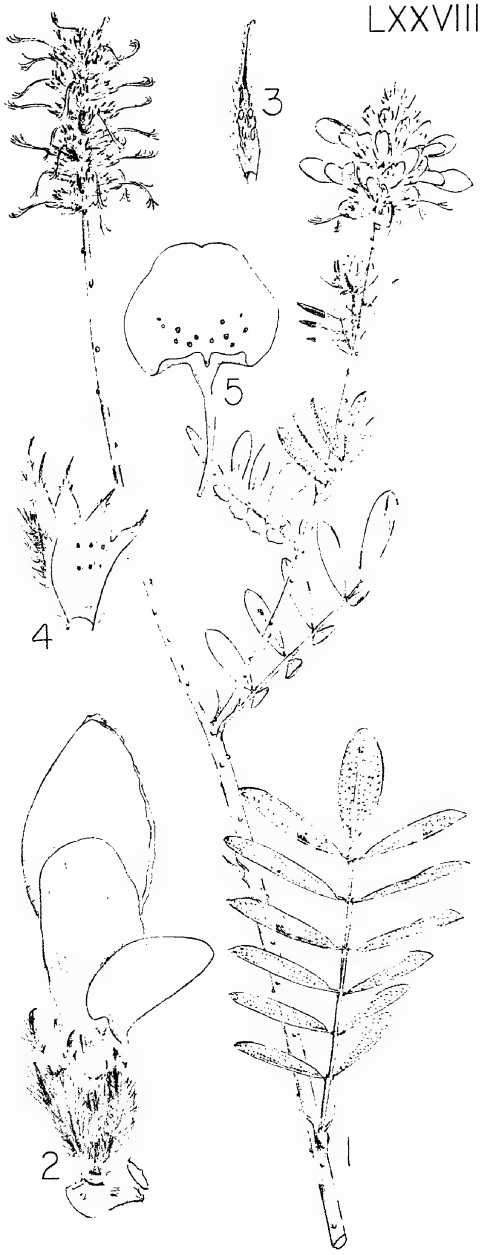
PLATE LXXVIII

Dalea jamesonii (Macbr.) Macbr. and **D. cuatrecasasii** Barneby, softly woody bushes of the n. Andes at elevations between 1800 and 3200 m; both have green foliage more or less finely strigulose-pilosulous and handsome bicolored flowers. The taxonomically isolated *D. jamesonii*, local in Ecuador, is instantly recognized by its externally glabrous, varnished calyx elevated on a slender, densely silky pedicel; the epistemonous petals, exceptionally long and narrow, are of an intense blue-purple unusual in the genus. The range of *D. cuatrecasasii* lies along the Eastern Cordillera in Colombia, largely within that of the related and habitally similar *D. coerulea* (Pl. LXXIX), from which it differs in the short-toothed calyx densely pilosulous from the very base upward, in the rose-purple (not vivid blue) epistemonous petals, and the dorsally glabrous banner. — Flowering branchlets × 1; the rest × 5.

D. jamesonii: 1) flowering branchlet; 2) flower + bract; 3) banner, ventral view; 4) pod.
D. cuatrecasasii: 1) flowering branchlet; 2) flower; 3) bract, ventral view; 4) calyx, laid open; 5) banner, ventral view.

DALEA JAMESONII

LXXVIII



DALEA CUATRECASASII

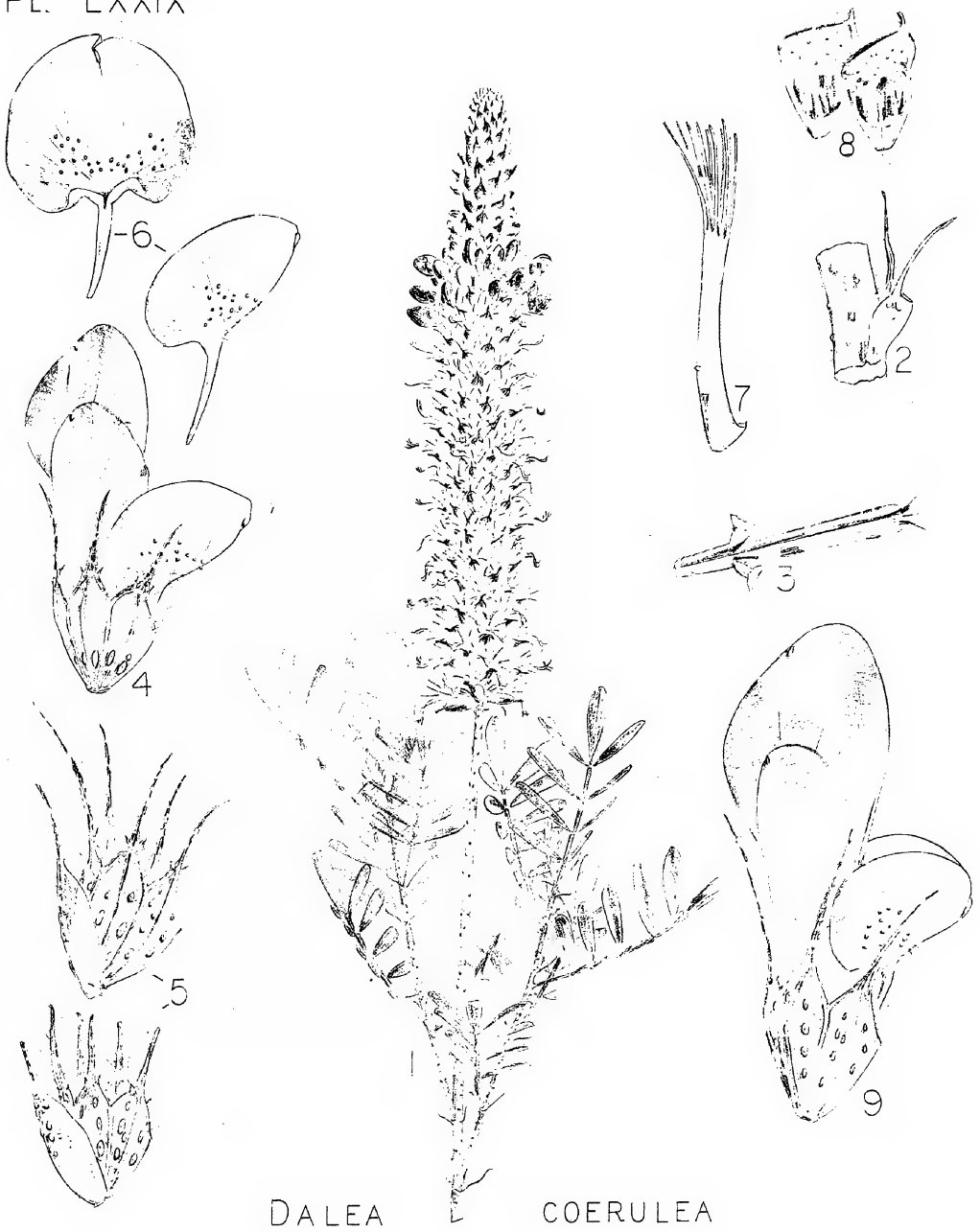
PLATE LXXIX

Dalea coerulea (Linnaeus f.) Schinz & Thellung, prototype of a group of potentially fruticose, tropical-montane daleas with expanded leaflets and bicolored flowers, the ample banner white and gland-sprinkled distally but colored at base like the wings and keel, vivid blue or less often purple. The range of *D. coerulea*, when adult a shrub 1.5–3 (exceptionally 5) m tall, extends at middle elevations along the Andes, mostly on the east slope, from Cordillera Oriental in Norte de Santander, Colombia, s. to Cuzco in Peru. Northward from Chachapoyas in Peru the species is represented by var. **coerulea**, relatively small-flowered, and southward through Peru by a large-flowered var. **longispicata** (Ulbrich) Barneby, with keel-blades ± 6–8 mm long and proportionately massive spikes of calyces. Among Andean daleas, *D. coerulea* and *D. ayavacensis* (Pl. LXXX) alone have elongate, aristiform and plumose calyx-teeth; the locally sympatric *D. ayavacensis* differs in the linear glands traversing the length of the intercostal panels of the calyx. — Habit × 1; the rest × 5.

var. *coerulea*: 1) top of flowering branchlet; 2) stipules; 3) segment of leaf-rachis, showing spiculiform intrapetiolular glands; 4) flower (from Colombia); 5) calyces + bract (both from Ecuador); 6) banner, ventral and profile views; 7) androecium; 8) pods.

var. *longispicata*: 9) flower.

PL. LXXIX



DALEA COERULEA

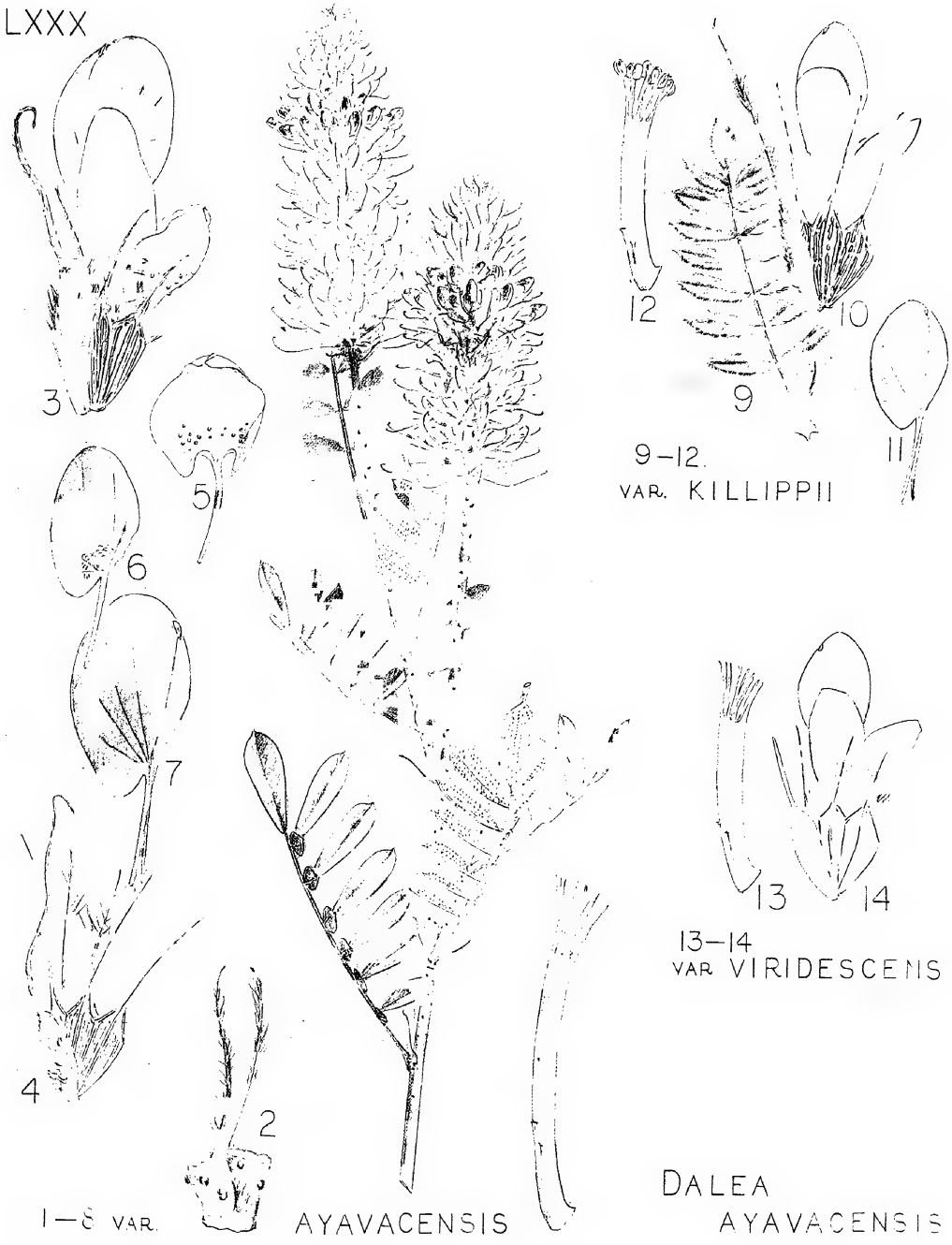
PLATE LXXX

Dalea ayavacensis Humboldt, Bonpland & Kunth, the rarer of the two Andean daleas with aristiform, plumose calyx-teeth, occurs within the range of the related *D. coerulea*, but only between s. Ecuador and centr. Peru; the two rows of confluent glands in each panel of the calyx-tube form the most easily observed differential character, often accompanied by long-tailed bracts. The var. **ayavacensis** is known presently from the Pacific slope in extreme n. Peru and adjoining Ecuador, and disjunctly on the headwaters of Río Apurimac in Cuzco and Apurimac. It has long-tailed bracts pubescent dorsally and relatively large flowers, the keel-baldes ± 4.5–6 mm long; the leaves are pilosulous but at least when adult green. The var. **killippii** (Macbride) Barneby is similar in most respects, but has densely silky foliage and small, pale blue flowers, the keel-blades ± 3.5 mm long; it is known only from s. Ecuador. The little known var. **viridescens** Barneby, known only from the type-locality in Cajamarca, n. Peru, resembles var. *ayavacensis* in its green foliage and var. *killippii* in its small, pale flower, but differs from both in the dorsally glabrous, short-tailed bracts and short calyx-teeth to match. — Inflorescence and detached leaves × 1; the rest × 5.

var. *ayavacensis*: 1) small segment of inflorescence; 2) stipules; 3) flower (from Loxa, Ecuador); 4) calyx + bract (from Cuzco, Peru); 5) banner (ventral view); 6) wing; 7) keel; 8) androecium.

var. *killippii*: 9) cauline leaf; 10) flower + bract; 11) keel; 12) androecium.

var. *viridescens*: 13) androecium; 14) flower + bract.


LXXX
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1—8 VAR. AYAVACENSIS
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VAR. KILLIPPII
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VAR VIRIDESCENS
DALEA
AYAVACENSIS

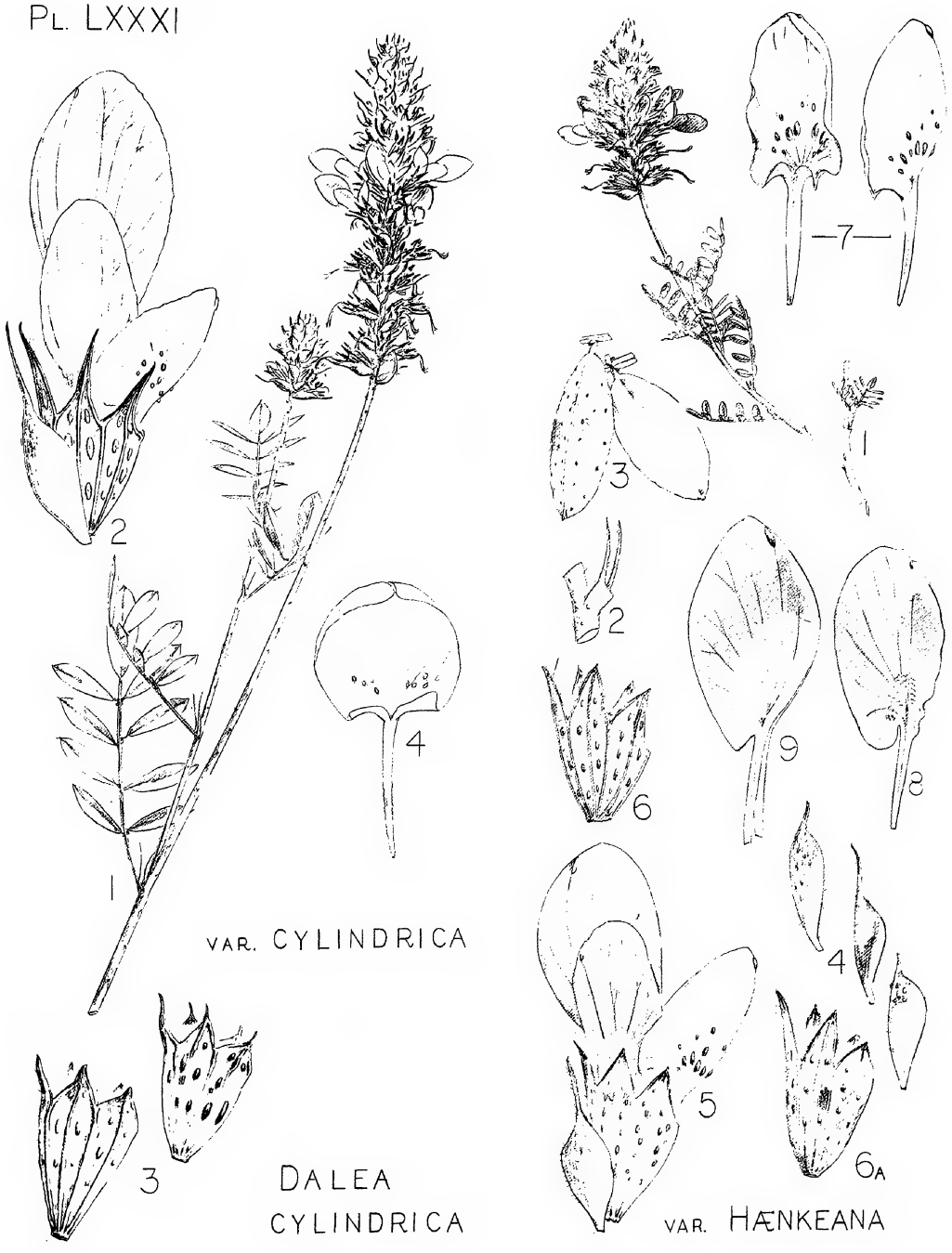
PLATE LXXXI

Dalea cylindrica Hooker (in part, continued on Pl. LXXXII), a polymorphic species of the Peruvian Andes, one variety extending into s. Ecuador. All forms of *D. cylindrica*, notable for its persistent bracts, are at least potentially suffruticose, but vary greatly in stature according to age and habitat, the var. *nova* reaching 2 m, the var. *haenkeana* sometimes forming prostrate mats. The var. **cylindrica**, dispersed along the Pacific slope between 800 and 3500 m between s. Cajamarca and Moquegua, has relatively few (mostly 5–15) and large, green leaflets, a calyx externally glabrous or only thinly pilose from middle upward, and epistemonous petals varying from pale yellow tinged with amethyst to lively red-purple, exceptionally blue. The var. **sulfurea** (Ulbrich) Barneby (not illustrated) has pale yellow petals combined with more densely pubescent foliage but is otherwise similar. The var. **haenkeana** Barneby, found in centr. Peru mostly in the drainage of Río Marañón, differs in its smaller leaflets and shorter spikes of usually blue flowers. The blue flower reappears in var. **nova** (Ulbrich) Barneby (Plate LXXXII), which differs from other forms of the species in its more numerous leaflets, 13–21 in most primary leaves and from var. *cylindrica* further in the calyx, pilose externally from base upward except for distally glabrate teeth. The var. *nova* is widespread, mostly on the Amazonian slope between 2000 and 3000 m, from Junín, Peru, n. to Chimborazo, Ecuador. In north-centr. Peru the varieties of *D. cylindrica* are all more or less confluent. — Habit × 1; the rest × 5.

var. *cylindrica*: 1) top of flowering stem; 2) flower + bract; 3) calyces; 4) banner, ventral view.

var. *haenkeana*: 1) flowering branchlet; 2) stipules; 3) leaflets; 4) bracts, all profile view; 5) flower + bract; 6, 6a) calyces; 7) banner, ventral and profile views; 8) wings; 9) keel.

PL. LXXXI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VAR. CYLINDRICA
DALEA
CYLINDRICA
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6A
VAR. HÆNKEANA

PLATE LXXXII

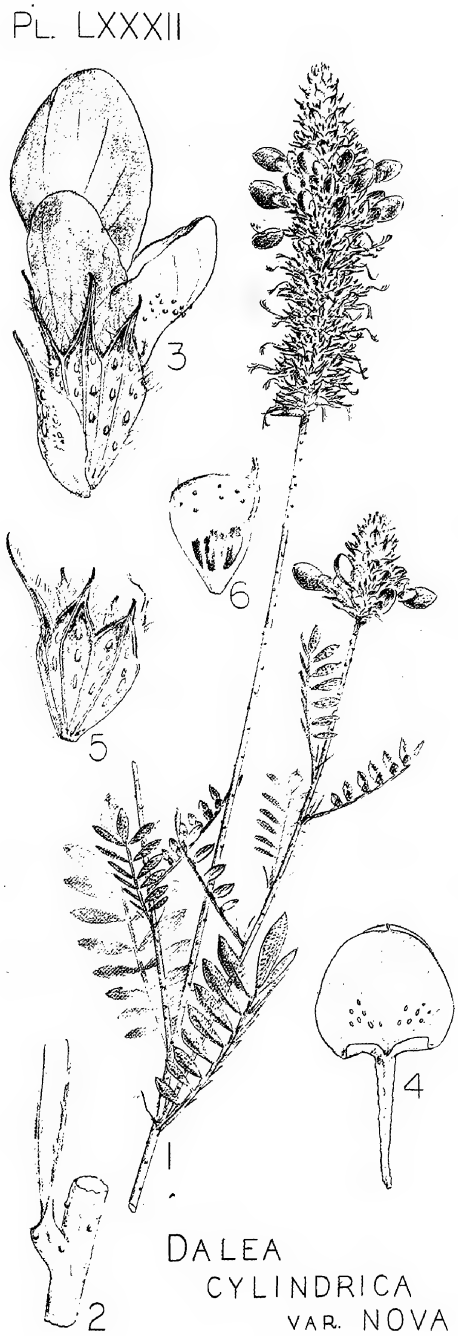
Dalea cylindrica Hooker var. **nova** (Ulbrich) Barneby and **D. weberbaueri** Ulbrich, suffrutescent Andean daleas variable in stature and habit, alike in the bicoloured flowers and dorsally glabrous, gland-dotted banner. They are sympatric through intermontane valleys of Peru from Junín n. to Cajamarca, there reaching the Pacific slope, and the var. *nova* extending thence n. into Ecuador. The latter, part of a complex species further illustrated in PL. LXXVIII, has green foliage, a calyx thinly pilose externally except toward the tips of the exceptionally firm and stiff-ribbed calyx-teeth, and epistemonous petals vivid blue (in this resembling the also sympatric *D. coerulea*, Pl. LXXIX, different in the plumose and longer teeth). The foliage of *D. weberbaueri* is at least when young gray-pilose or silvery-silky, the calyx is finely ribbed and pubescent throughout, and the epistemonous petals are more often purple than blue. Two varieties of *D. weberbaueri* have been described, the typical with greenish-gray leaflets and short-tailed bracts, and var. **sericophylla** (Ulbr.) Barneby with permanently silky leaflets and long-tailed bracts. — Habit × 1; the rest × 5.

D. cylindrica var. *nova*: 1) flowering branchlet; 2) stipules; 3) flower + bract; 4) banner, ventral view; 5) fruiting calyx; 6) pod.

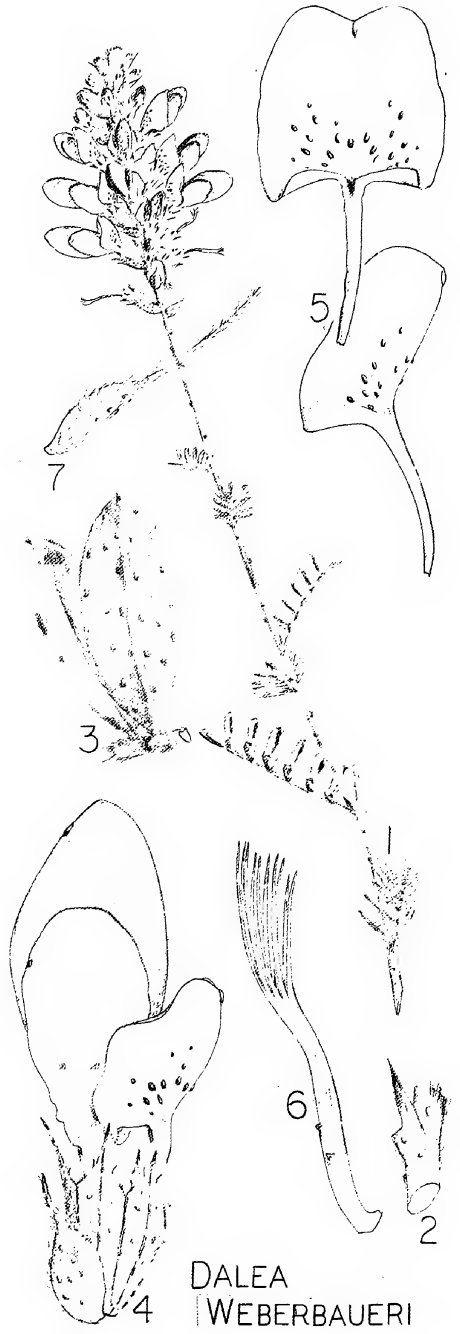
D. weberbaueri var. *weberbaueri*: 1) flowering branchlet; 2) stipules; 3) leaflets; 4) flower + bract; 5) banner, ventral and profile views; 6) androecium.

D. weberbaueri var. *sericophylla*: 7) interfloral bract.

PL. LXXXII



DALEA CYLINDRICA VAR. NOVA



DALEA WEBERBAUERI

PLATE LXXXIII

Dalea myriadenia (left) and **D. galbina** (right), two shrubby species with green foliage and warty stems, of local dispersal in the Peruvian Andes in latitude 6–12° S. The petals of *D. myriadenia* of the Marañón drainage in Cajamarca and Amazonas are bicolored, the banner white beyond the basal lobes, fading purple, the rest vivid blue; the petals of *D. galbina* of the Huallaga valley in Huánuco are concolorous, all pale greenish yellow. Note the persistent bracts and broad, short calyx-teeth of *D. myriadenia*; the deciduous bracts, unique twenty-ribbed calyx and small leaves of *D. galbina*. Inflorescences × 1; the rest × 5.

D. myriadenia: 1) flowering branchlet; 2) stipule; 3) leaflet, dorsal view; 4) bracts, profile and ventral views; 5) flower + bract; 6) calyx; 7) banner, ventral view; 8) androecium; 9) pod.

D. galbina: 1) flowering branchlet; 2) leaf + stipules; 3) bract, ventral view; 4) flower + bract, the latter caducous by full anthesis; 5) part of calyx laid open, the ventral sinus at left; 6) banner, ventral view; 7) wing; 8) keel; 9) androecium.

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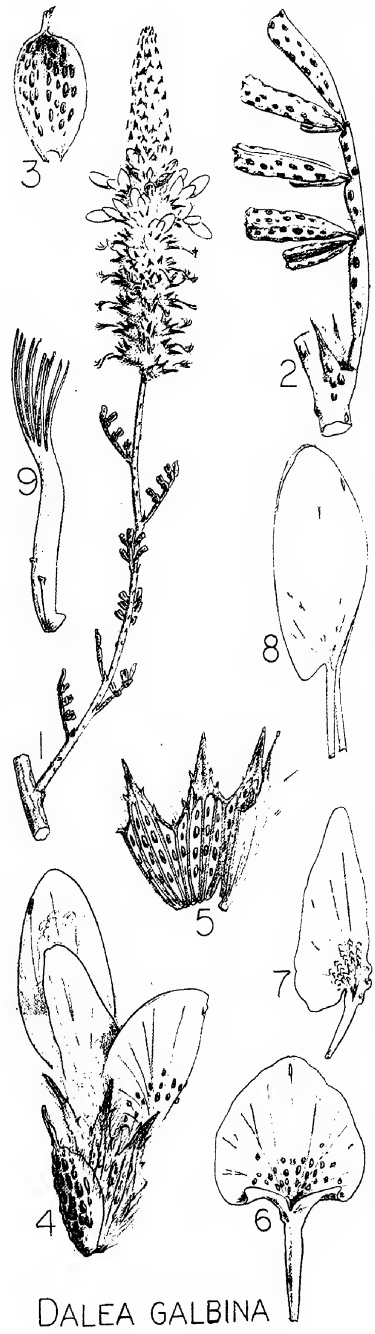
DALEA
MYRIADENIA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DALEA GALBINA

PLATE LXXXIV

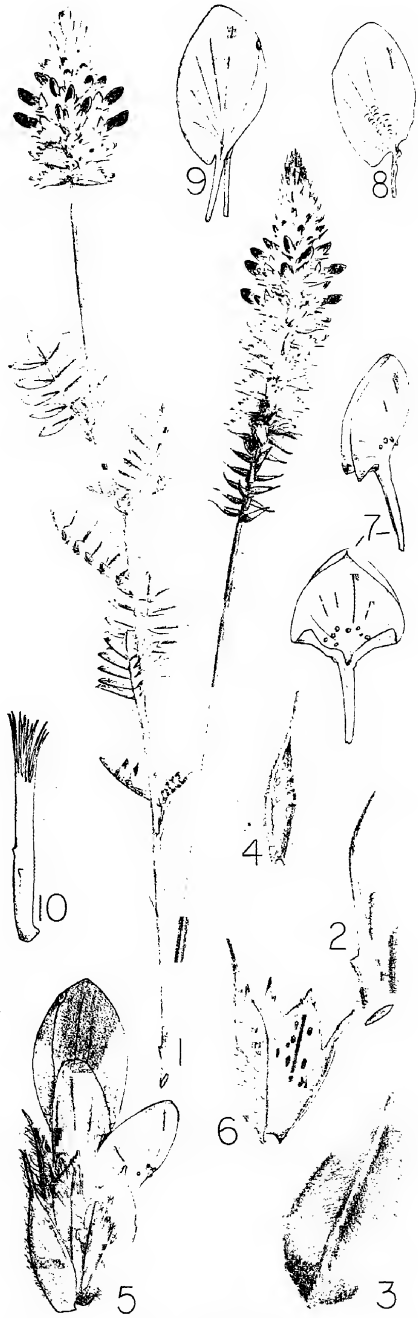
Dalea fieldii (Macbr.) Macbr. and **D. chrysophylla** Barneby, suffrutescent herbs or weakly woody bushes of middle elevations in the Andes, apparently rare and local, the former in centr. Peru (Pasco), the latter in Ecuador (Azuay). Both have copiously pubescent stems and foliage and moderately dense spikes of blue-and-white flowers subtended by persistent bracts. The leaflets of *D. fieldii* are of thin texture, relatively ample, and although finely pilosulous all over are greenish or greenish-gray when adult, the bracts are drawn out into a caudate tail, the dorsal calyx-tooth is only slightly shorter than the tube, and the large epistemonous petals are clear but pale blue. The foliage of *D. chrysophylla* is densely tomentulose, the vesture turning golden when dry, the bracts and calyx-teeth are relatively short, and the small inner petals are intense cobalt blue. — Flowering branchlets × 1; leaflets of *D. fieldii* (fig. 7) × 3; the rest × 5.

D. fieldii: 1) tip of flowering stem; 2) flower + bract; 3) bract, profile view; 4) banner, ventral view; 5) wing; 6) androecium; 7) leaflet, dorsal view.

D. chrysophylla: 1) flowering summit; 2) stipule; 3) leaflet, dorsal view; 4) bract, ventral view; 5) flower + bract; 6) calyx, laid open; 7) banner, profile and ventral views; 8) wing; 9) keel; 10) androecium.

PL. LXXXIV

DALEA FIELDII



DALEA CHRYSOPHYLLA

PLATE LXXXV

Dalea onobrychis DeCandolle and **D. kuntzei** Harms, suffruticose Andean daleas with the bicolored flower common to most species of ser. *Coeruleae*, the keel and wings amethyst-purple in the latter, but as often vivid blue in *D. onobrychis*. The green but thinly puberulent *D. onobrychis* is a tall plant, 6–15 dm high, with at least some long-pedunculate spikes; its range lies along the west slope of the Andes in middle and southern Peru, where it coincides with *D. cylindrica* var. *cylindrica* (Pl. LXXXI), from which it may be distinguished by the broad, membranous, deciduous interfloral bracts densely pubescent on the back. The comparatively rare *D. kuntzei*, with stems up to ± 5 dm tall and glabrous leaves, is known only from the east edge of the Bolivian Plateau in Santa Cruz, and differs from all Andean kindred in its long, linear-oblanceolate leaflets. Its close relative is *D. elegans* (Pl. LXXXIX), which has the same flowers but different leaves, and which takes its place immediately southward. — Stems × 1; the rest × 5.

D. onobrychis: 1) top of flowering stem; 2) stipules; 3) leaflet, dorsal view; 4) bracts, the two upper ventral, lower dorsal view; 5) flower; 6) calyx, laid open; 7) banner, ventral view; 8) wing; 9) keel; 10) androecium.

D. kuntzei: 1) flowering branchlet; 2) stipules; 3) leaflet, dorsal view; 4) flower + bract; 5) banner, ventral view; 6) wing; 7) keel; 8) androecium; 9) pod.

LXXXV
DALEA ONOBRYCHIS
DALEA KUNTZEI

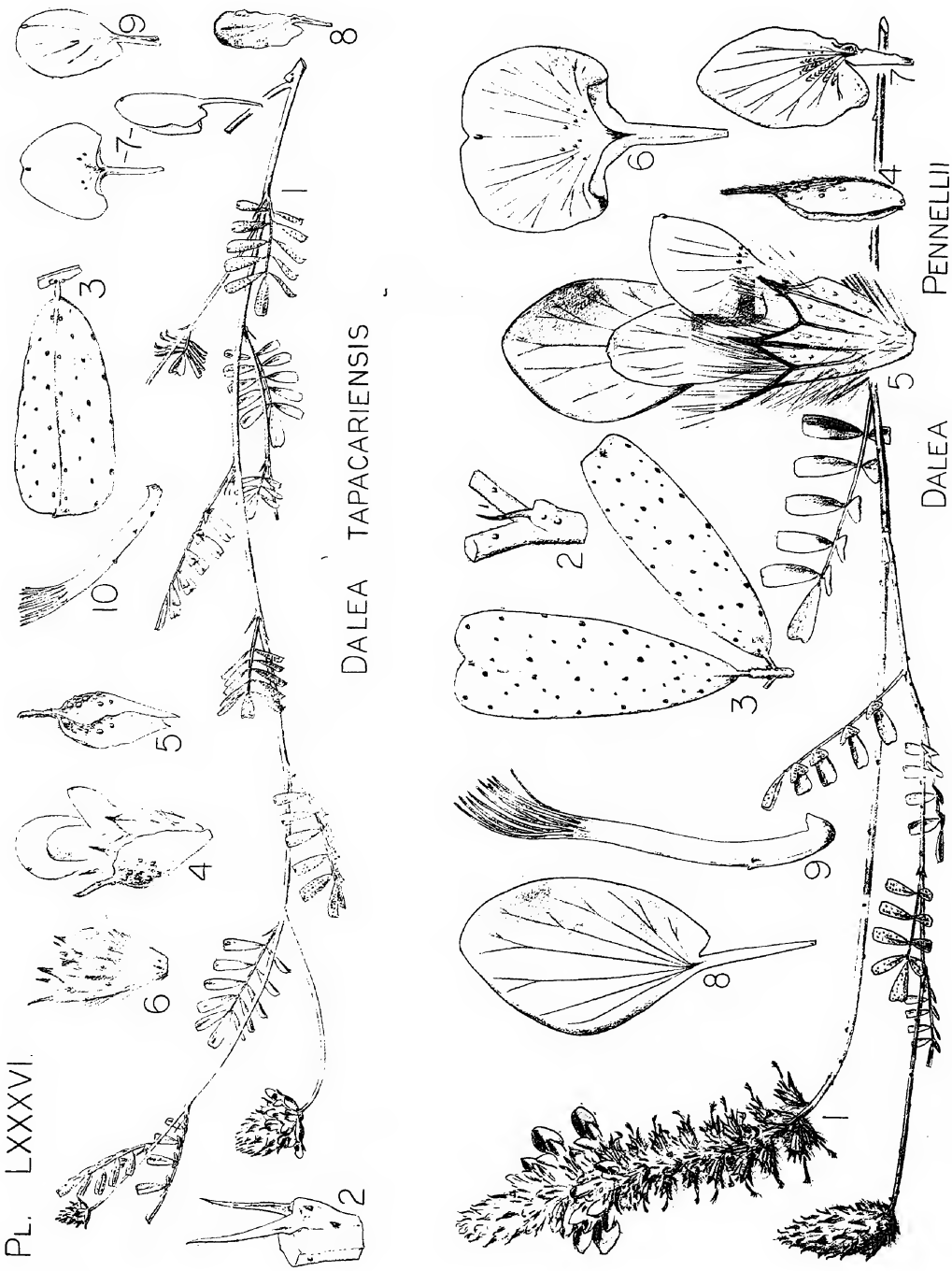

PL. LXXXVI
DALEA TAPACARIENSIS
DALEA PENNELLII

PLATE LXXXVI

Dalea tapacariensis Harms and **D. pennellii** (Macbride) Macbride, members of the Andean ser. *Coeruleae* with green, glabrous or thinly pilosulous foliage and bicolored flowers. The monocarpic or short-lived *D. tapacariensis*, known only from the Bolivian plateau in Cochabamba, resembles the sympatric *D. boliviana* (Pl. LXXXVIII) in habit, but differs in the tiny flower, which is white except for a vivid blue spot on either wing-tip, a color-pattern unknown among kindred species. The strongly perennial *D. pennellii* of the Pacific slope in Arequipa, Peru and adjoining Chile resembles *D. azurea* and *D. smithii* (PL. LXXXVII) in the promptly deciduous interfloral bracts, but differs from both in its humifuse stems and usually amethyst-purple (not vivid blue) epistemonous petals. — Habit × 1; the rest × 5.

D. tapacariensis: 1) top of stem; 2) stipules; 3) leaflet, dorsal face; 4) flower + bract; 5) bract, ventral view; 6) calyx; 7) banner, ventral and profile views; 8) wing; 9) keel; 10) androecium.

D. pennellii: 1) top of stem; 2) stipules; 3) terminal leaflets (dorsal view); 4) bract, profile; 5) flower; 6) banner, ventral view; 7) wing; 8) keel; 9) androecium.

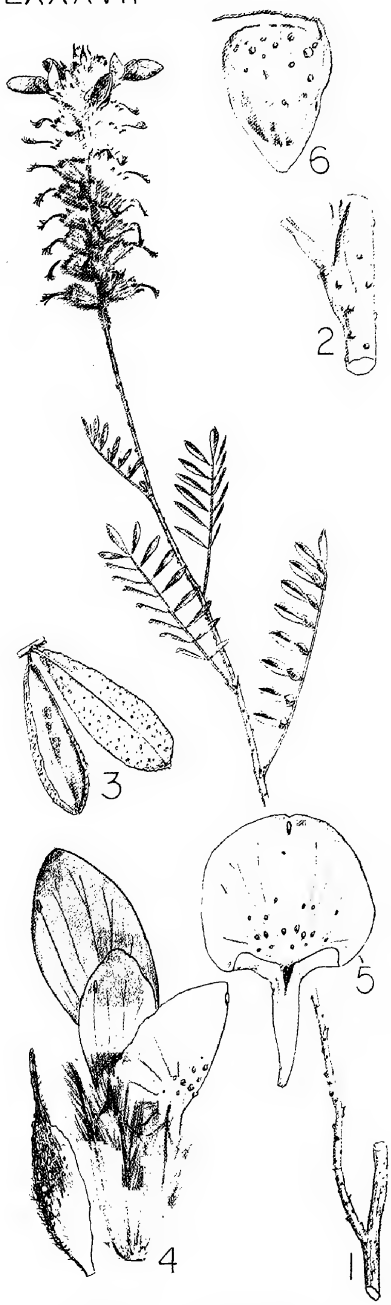
PLATE LXXXVII

Dalea smithii Macbride and **D. azurea** (Philippi) Reiche, are Andean daleas, early suffruticose becoming shrubby and up to 6–20 dm tall, with either erect or straggling, warty stems, greenish but at least thinly pilosulous foliage, and bicolored flowers, the white (but rubescent, and often basally blotched), gland-sprinkled banner contrasting with bright blue wings and keel. Both are notable for deciduous bracts which fall away from the flower-buds as the corolla expands. The range of *D. smithii* lies in the inter-Andean valleys of s. Peru drained by the Mantaro, Apurimac, and Urubamba rivers in departments of Apurimac, Hancavelica, and Cuzco. The species closely resembles the vicariant *D. pazensis* (Pl. LXXXVIII) except in the caducous bracts. The exceptionally handsome *D. azurea* is a low bush found in Atacama fog-desert in Antofagasta, Chile, the only true dalea known to occur so far south on the Pacific slope. — Habit × 1; the rest × 5.

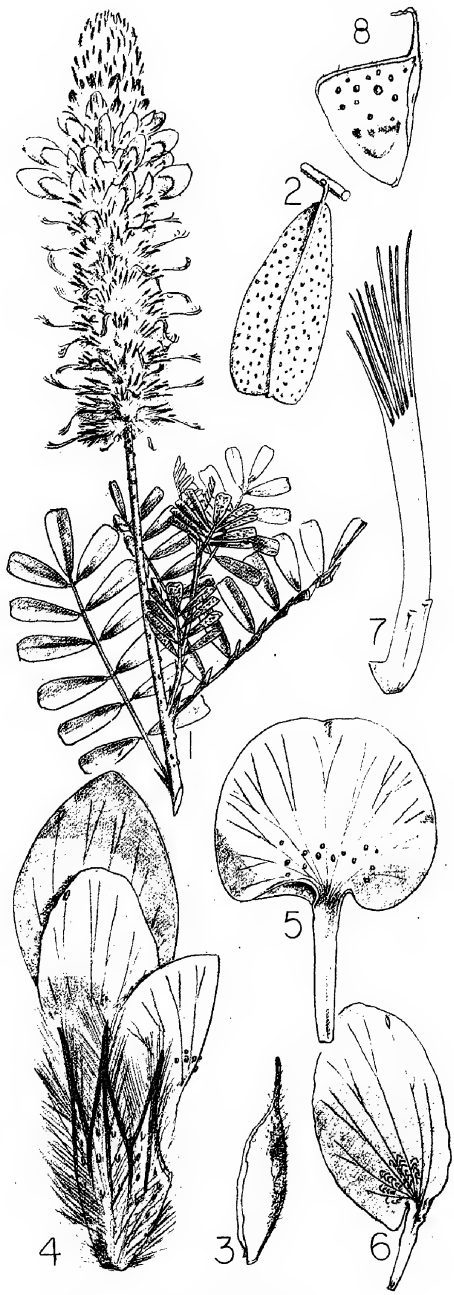
D. smithii: 1) top of stem; 2) stipules; 3) leaflets; 4) flower + bract; 5) banner, ventral view; 6) keel; 7) pod.

D. azurea: 1) top of stem; 2) leaflet, dorsal view; 3) bract, profile; 4) flower; 5) banner, ventral view; 6) wing; 7) androecium; 8) pod.

LXXXVII



DALEA SMITHII



DALEA AZUREA

PLATE LXXXVIII

Dalea pazensis Rusby and **D. boliviana** Britton grow together on the Bolivian Plateau and while much alike in the persistent bracts and details of the individual flower differ greatly in stature, habit, and foliage. The erect stems of *D. pazensis*, endemic to this region, become fruticose and up to 6–20 dm tall; the primary cauline leaves have 7–11 pairs of leaflets; and the epistemonous petals are vivid blue. The plant differs from the kindred but Peruvian *D. smithii* (Pl. LXXXVII) in its persistent interfloral bracts. The stems of *D. boliviana*, which extends n. into Ayacucho, Peru and s. to Catamarca, Argentina, are herbaceous above the shortly forked woody caudex, diffuse or prostrate, and less than 5 dm long; the leaflets are 4–8 pairs; and the petals sometimes blue and sometimes amethyst-purple. The leaflets of *D. boliviana* vary in outline from oblong-obovate to obcordate, the latter type prevailing from s. Bolivia s.-ward. — Habit × 1; the rest × 5.

D. pazensis: 1) top of flowering stem; 2) stipules; 3) leaflets; 4) flower + bract; 5) calyx, laid open; 6) keel; 7) androecium.

D. boliviana: 1) top of flowering stem; 2) stipules; 3) leaflets, of broader and narrower types; 4) flower + bract; 5) do., epistemonous petals removed to show androecium with 5 large, 5 small anthers; 6) bract, dorsal view; 7) banner, ventral view; 8) keel.

LXXXVIII

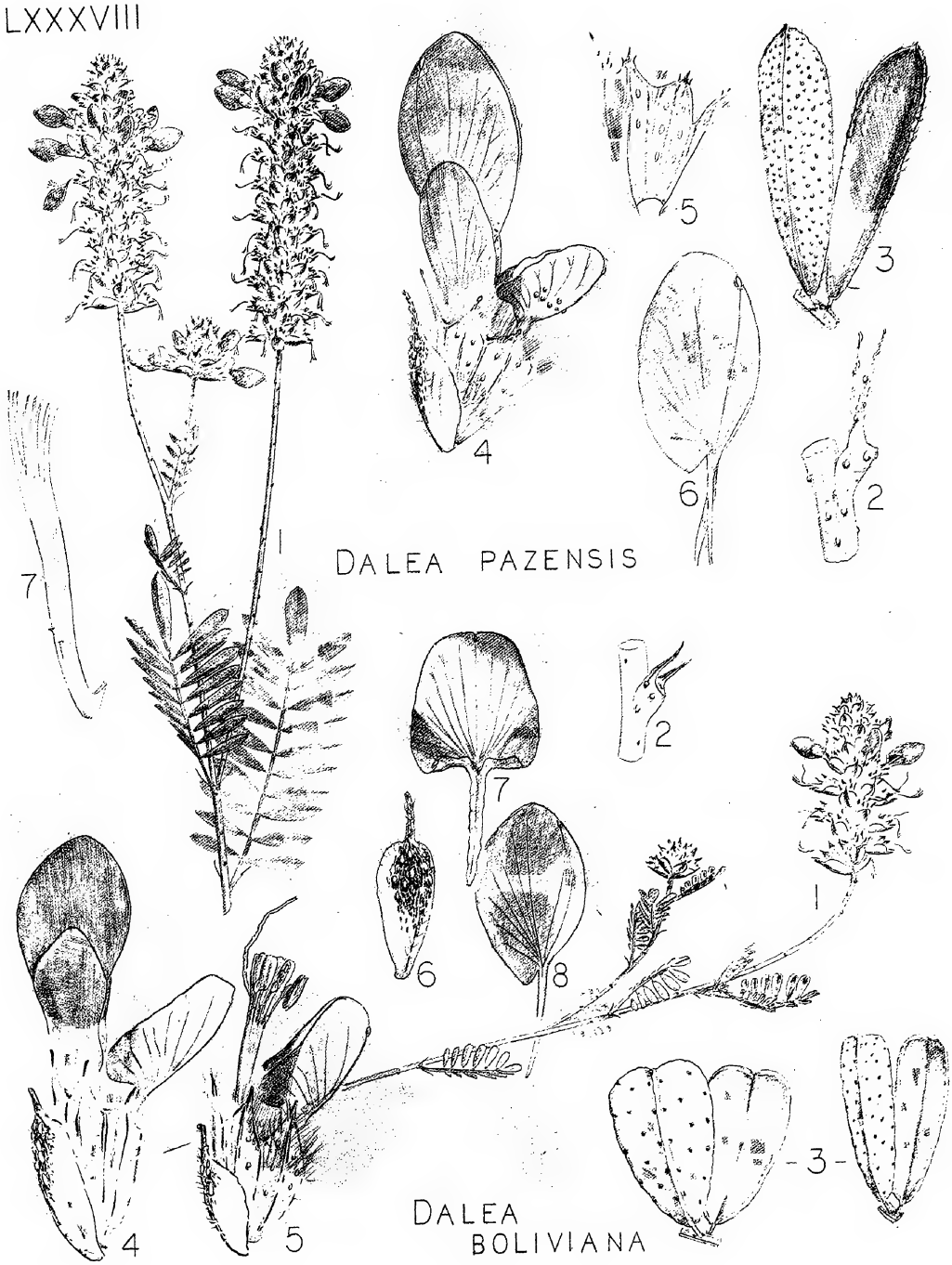
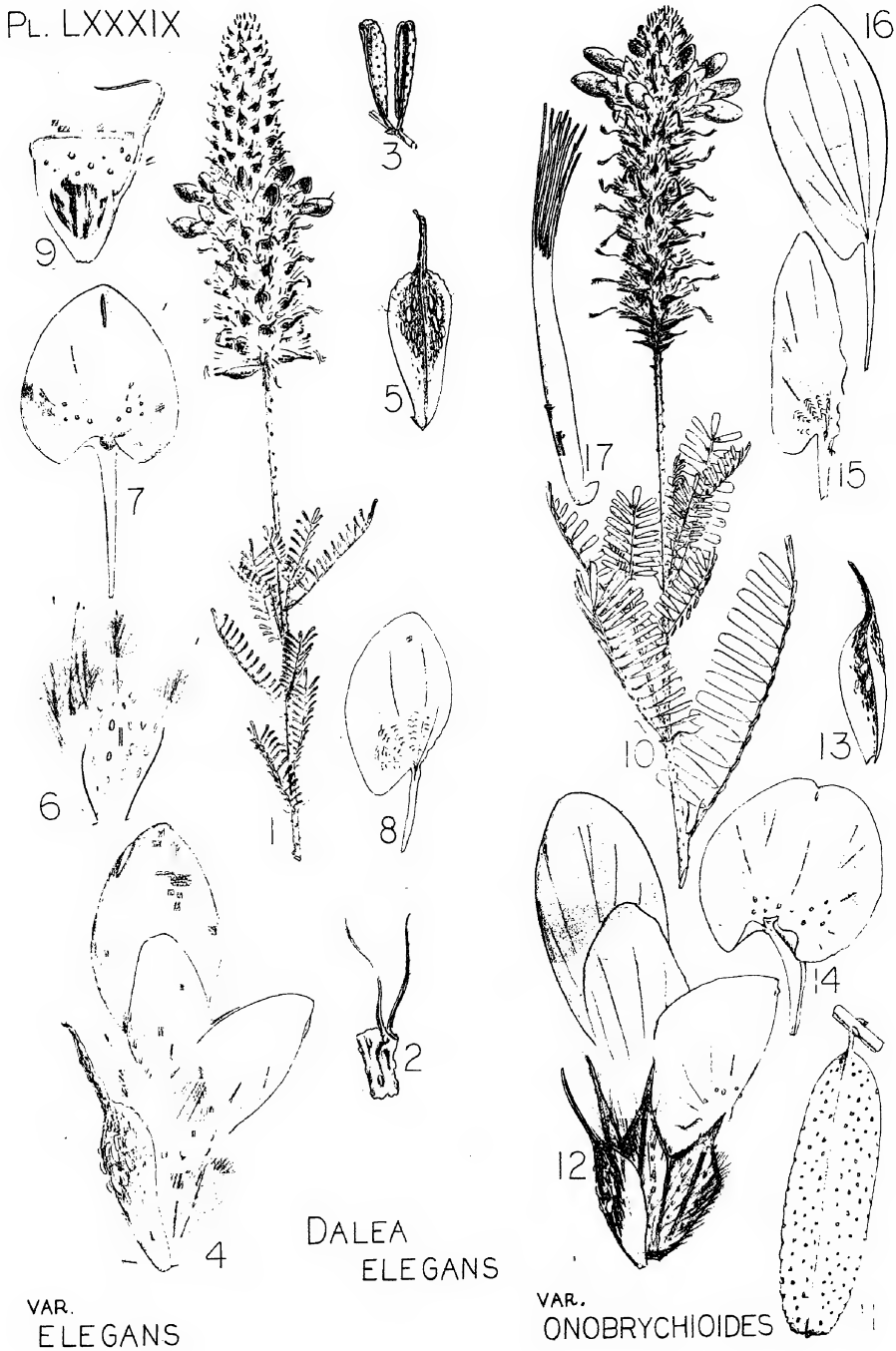


PLATE LXXXIX

Dalea elegans Gill. is dispersed along the east slope and piedmont of the Andes from the department of Tarija in extreme southern Bolivia south in Argentina to Salta and further, through Sierra Grande de Córdoba to Sierra San Luis, where it attains the southern limit of the genus in lat. 33° S. Among Andean daleas it is remarkable chiefly for the many pairs of leaflets, which vary however greatly in size and texture. The xerophytic var. **elegans**, a low, scarcely suffruticose herb with mostly monocephalous stems up to 5 dm long, has small, crowded, fleshy leaflets; the banner is partly white, the inner petals amethyst-purple. Its range extends south from Salta and below 2000 m along the Andean foothills and the detached ranges east of the Andes proper. The tall, weakly frutescent var. **onobrychioides**, with several-headed stems, reaching 6–12 dm in height, has expanded leaflets of thinner texture; the flower is all blue, except for a small white eye in the banner. The var. *onobrychioides* is strictly Andean, ranging north from Salta, mostly above 2000 m, through Jujuy into Bolivia. Inflorescences × 1; the rest × 5.

var. *elegans*: 1) top of stem; 2) stipules; 3) leaflets; 4) flower + bract; 5) bract, dorsal view; 6) calyx, laid open; 7) banner, ventral view; 8) wing; 9) pod.

var. *onobrychioides*: 10) summit branchlet; 11) leaflet, dorsal view; 12) flower + bract; 13) bract, half-profile; 14) banner; 15) wing; 16) keel; 17) androecium.


PL. LXXXIX
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DALEA
ELEGANS
VAR.
ELEGANS
VAR.
ONOBRYCHIOIDES

PLATE XC

Dalea humifusa Bentham and **D. exilis** DeCandolle, diffuse or prostrate Andean species with small bicolored flowers, the epistemonous petals usually vivid ultramarine blue, rarely purple, exceptionally pink or whitish. The densely matted *D. humifusa* is endemic to the high central valley of Ecuador, associated with pumice sands at foot of the great volcanic cones. It has the smallest leaves and flowers of all perennial Andean daleas. The always pubescent foliage varies from green and sharply dotted to ashen or even silvery-pilosulous; the calyx may be pilose from base upward or glabrous below the barbate teeth. The more glabrous, always green-leaved *D. exilis* ranges through inter-Andean valleys of n. and centr. Peru at 2100–3500 m, from Amazonas to Junín, and feebly w. to the Pacific slope in Ancash and Lima. In flower-size it is intermediate between *D. humifusa* and *D. boliviana*, with which it intergrades at its s. limit.— Habit × 1; the rest × 5.

D. humifusa: 1) flowering branchlet; 2) leaflets; 3) flower + bract; 3 a) calyx, externally glabrate; 4) calyx, laid open; 5) banner, ventral view; 6) wing and keel; 7) androecium; 8) pod.

D. exilis: 1) top and base of flowering stem; 2) flower + bract (from Junín); 3) bract from same, dorsal view; 2a) flower + bract (from Amazonas); 3a) bract from same, dorsal view; 4) calyx + bract; 5) calyx, laid open; 6) banner, ventral view; 7) wing-petal; 8) pod.

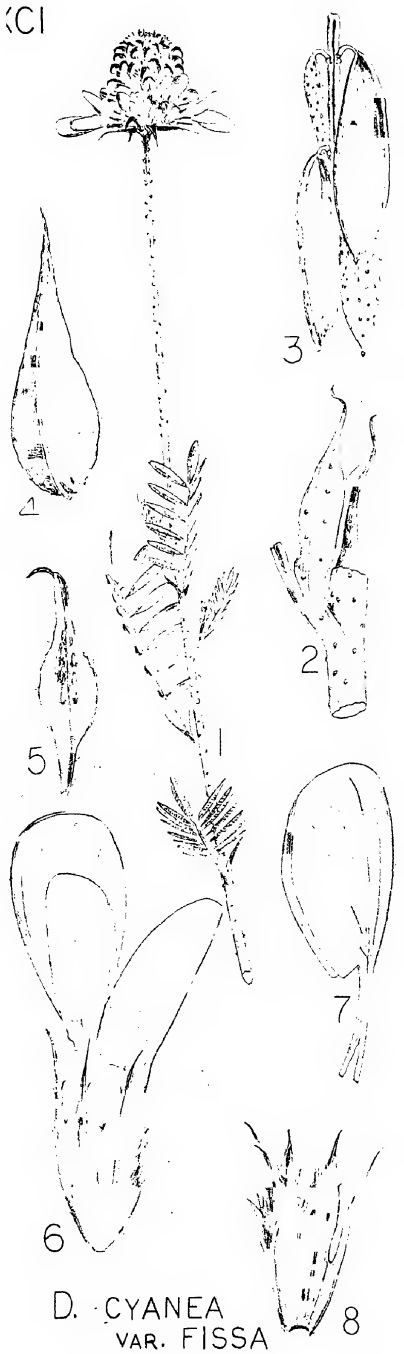
PL. XC

PLATE XCI

Dalea cyanea Greene, a diffusely ascending, polypodial, perennial herb of local dispersal in the pine-oak belt of Sierra Madre Occidental in s.-w. Durango and n. Nayarit, where it is found in flower in late summer and fall. The plants differ greatly in density and distribution of the pubescence, the foliage varying from gray-pilose to bright green and glabrous, but even in the most nearly hairless forms some remnant of vesture can be found at base of the stem, on the leaf-stalks, or under the flower-heads. Notable features of the species are the dense, headlike spikes, the dimorphic bracts, the short-toothed, bell-shaped calyx deeply recessed behind the ample banner. The proportionately large and showy flowers open bicolored, the banner white or largely so, finally rubescent, the wings and keel brightly anthocyanic. The var. **cyanea**, known only from the east slope of the Sierra near the latitude of Ciudad Durango, has small bracts, and inner petals vivid blue. The poorly known var. **fissa** (Rydb.) Barneby, from the n. end of Sierra de Nayarit, has exceptionally large, castaneous bracts, and rose-purple wings and keel. — Stems × 1; the rest × 5.

var. *cyanea*: 1) top of stem; 2) stipules; 3) leaflets; 4) outermost bract, dorsal view; 5) flower + inner bract, twisted to show glabrous ventral face; 6) calyx, laid open; 7) banner, ventral and profile views; 8) wing; 9) keel; 10) androecium; 11) pod.

var. *fissa*: 1) flowering branchlet; 2) stipules; 3) leaflets in sleeping posture; 4) lower bract, dorsal view; 5) inner bract, ventral view; 6) flower; 7) keel; 8) calyx, laid open.

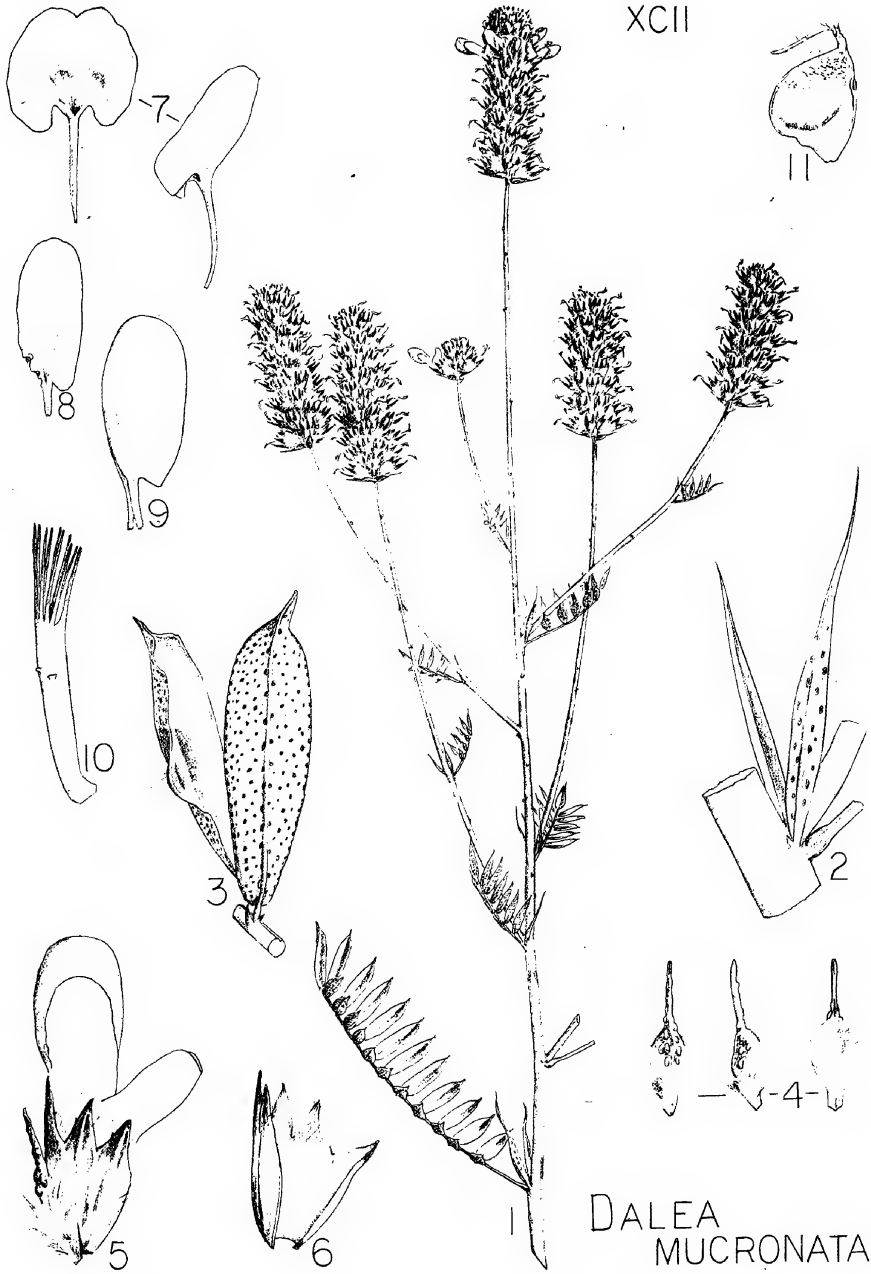

D. CYANEA
VAR. FISSA

DALEA CYANEA
VAR. CYANEA

PLATE XCII

Dalea mucronata DC., a tall herb flowering in late summer and fall, endemic to the Valley of Mexico and foothills bordering the valley of the Lerma River downstream to Guadalajara. The one to several leafy wandlike stems reach a stature of 1–2 meters and branch at apex into a panicle of proportionately small spikes. The foliage is green, hairless or nearly so, the calyx is glabrous and lustrous externally but its orifice silvery-pubescent within, and the petals are greenish-creamy, the green-eyed banner fading dull reddish. Note the long, narrow stipules, the acuminate leaflets of thick texture, and the internally silky bracts. — Panicle × 1, the rest × 5.

1) Inflorescence; 2) stipules; 3) leaflets; 4) bracts, left to right a dorsal, profile and ventral view; 5) flower + bract; 6) calyx, laid open; 7) banner, ventral and profile views; 8) wings; 9) keel; 10) androecium; 11) pod.


XCII
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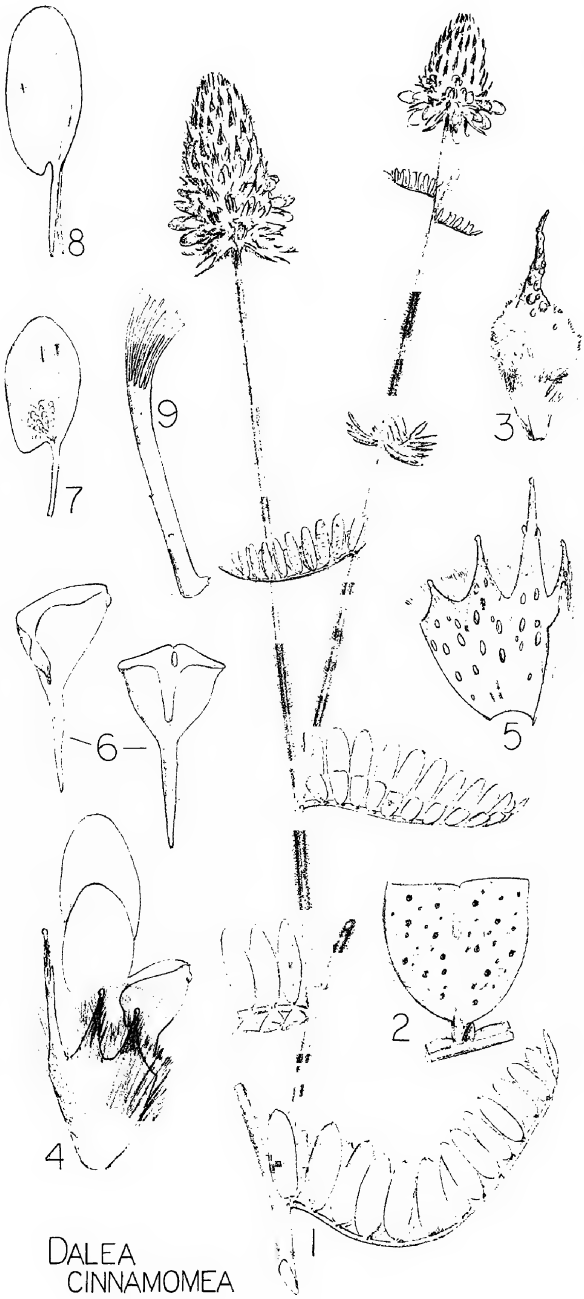
DALEA
MUCRONATA

PLATE XCIII

Dalea cinnamomea Barneby and **D. tomentosa** (Cav.) Willd. var. **mota** Barneby. The var. *mota*, a silvery pubescent shrub with conelike heads of small lavender flowers, endemic to the w. slope of the Sierra Madre in s. Sonora and Sinaloa, is part of a widely dispersed species illustrated further on Plate XCIV. The softly tomentulose *D. cinnamomea*, at first merely suffruticose but becoming an awkwardly and irregularly branching shrub attaining a stature of 2.5 m, is known only from brushy hill country at ± 1200–1500 m in w. Puebla and adjoining Morelos. The dense heads of flower develop in the dry season, starting in October and continuing into winter. The petals open brownish-pink and fade to a cinnamon-brown, a color known in no other dalea. Leaves deflexed at base but incurving distally seem characteristic of the species.— Inflorescences × 1; the rest × 5.

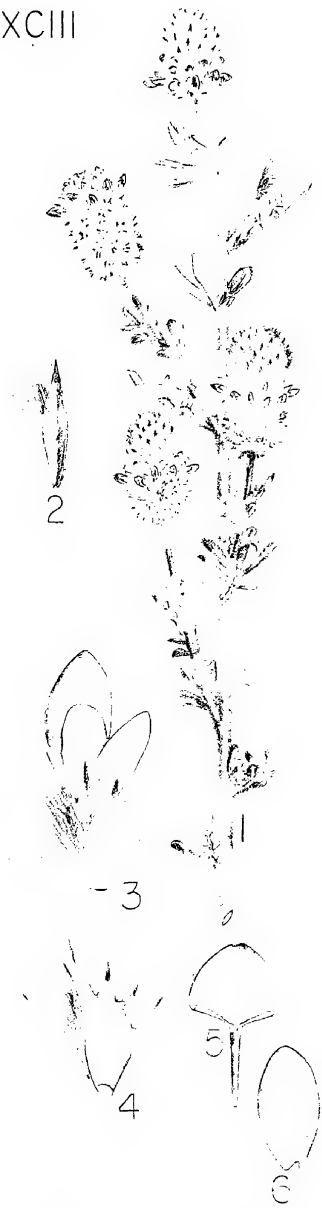
D. cinnamomea: 1) summit branch; 2) leaflet, dorsal view; 3) bract, dorsal view; 4) flower; 5) calyx, laid open; 6) banner, half-profile and ventral views; 7) wing; 8) keel; 9) androecium.

D. tomentosa var. *mota*: 1) part of panicle; 2) bract, ventral view; 3) flower; 4) calyx, laid open; 5) banner, ventral view; 6) keel.



DALEA CINNAMOMEA

XCIII



D. TOMENTOSA VAR. MOTA

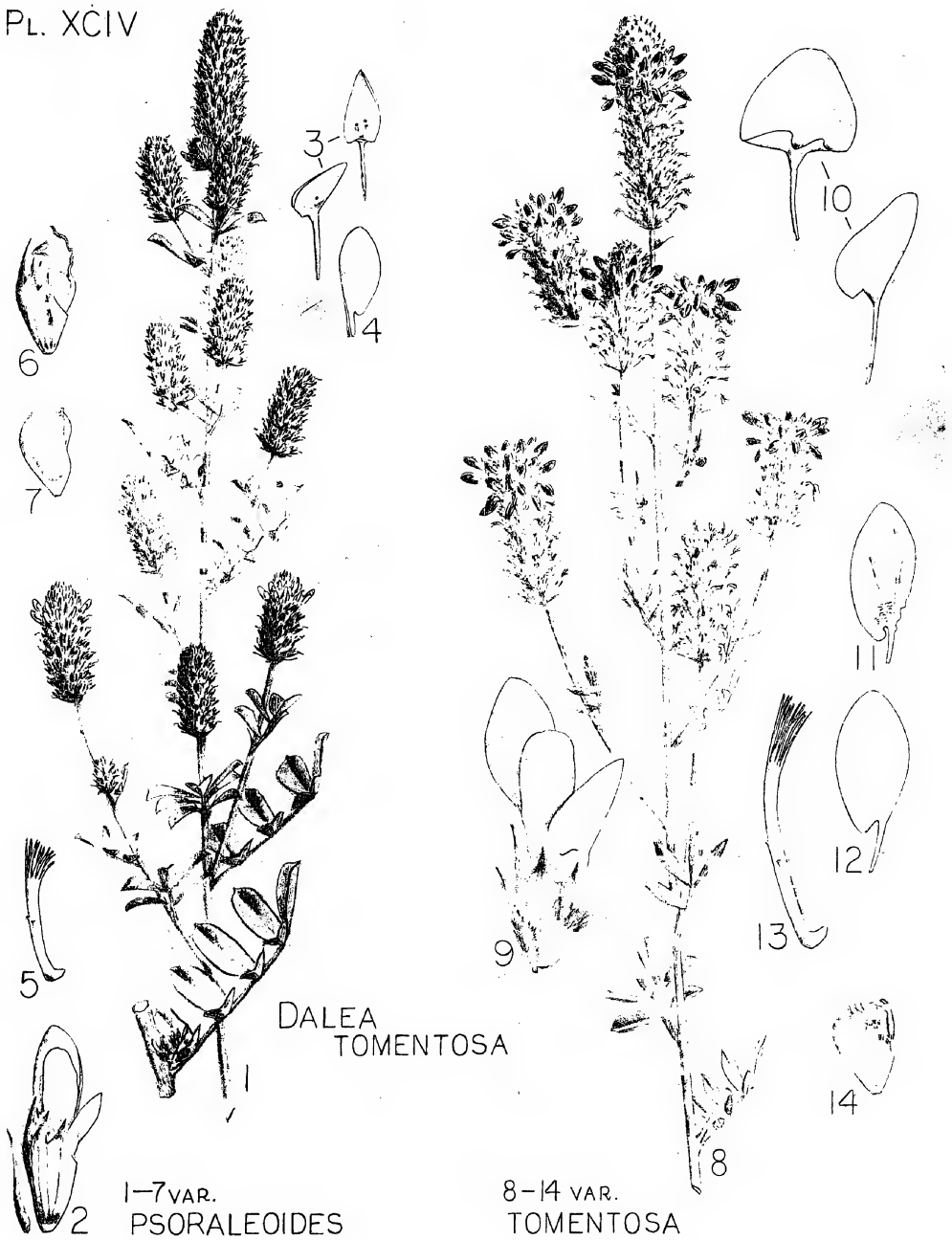
PLATE XCIV

Dalea tomentosa (Cav.) Willd., a precociously flowering but potentially shrubby dalea reaching a stature of 2 m, widely dispersed through the Neovolcanic Belt in Mexico, whence it extends commonly s. and e., in oak-pine forest and grassland, to the highlands of Guatemala and El Salvador, and n.-w., along the Pacific slope of the Mexican Plateau, to s. Sonora. The stems and foliage are always densely pubescent, but the leaves vary from greenish to silvery-white; the petals may be whitish, pink, or vivid purple. The var. **psoraleoides** (Moric.) Barneby, which represents the species over nearly its whole range s.-ward from central Sinaloa, is characterized by its stiffly branched, narrowly pyramidal or thyrsiform panicle of heads; its flower is always small, the inner petals whitish to pale pink. The more local var. **tomentosa**, found in the valley of the Lerma-Santiago river in Jalisco and Nayarit, and disjunctly on the Caribbean slope of the Orizaba massif in Veracruz, resembles the preceding except that the flower is larger and more richly colored, and the calyx is usually more densely hairy. The var. **mota** Barneby (illustrated in Plate XCIII), known only from s. Sonora and Sinaloa, has silvery foliage, relatively few and thick heads arranged in a broadly pyramidal panicle, and lilac petals. — Inflorescences × 1; the rest × 5.

var. *psoraleoides*: 1) upper part of panicle + a main cauline leaf; 2) flower + bract; 3) banner, profile and ventral views; 4) keel; 5) androecium; 6) fruiting calyx; 7) pod.

var. *tomentosa*: 8) upper part of panicle; 9) flower + bract; 10) banner, ventral and profile views; 11) wing; 12) keel; 13) androecium; 14) pod.

PL. XCIV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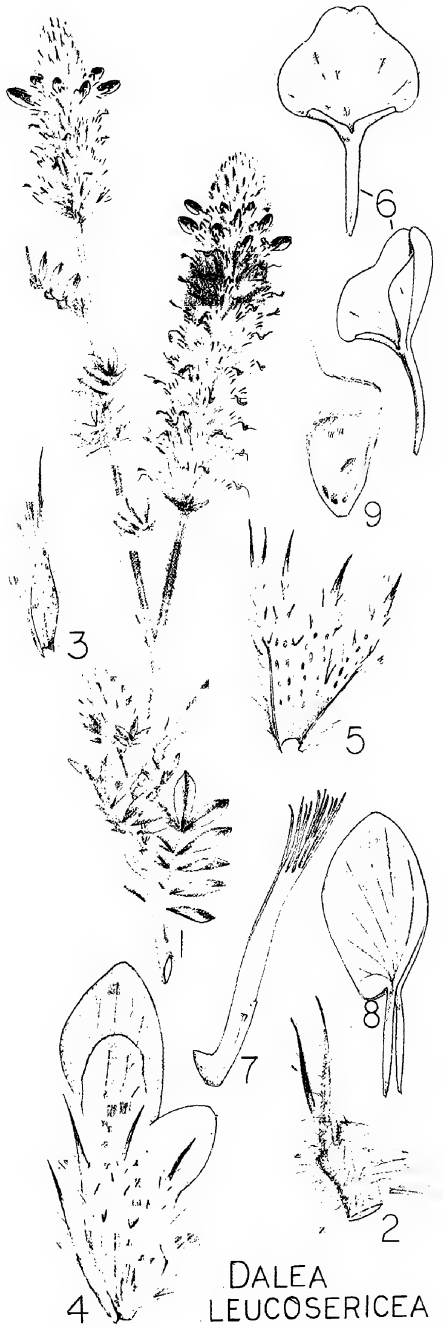
DALEA
TOMENTOSA
1–7 VAR.
PSORALEOIDES
8–14 VAR.
TOMENTOSA

PLATE XCV

Dalea leucosericea (Rydb.) Standl. & Steyerm. and **D. bacchantum** Barneby are shrubby or at least suffruticose daleas of southern Mexico, flowering in fall and winter; both have copiously pubescent foliage, 3–6 pairs of relatively large leaflets, and bicolored flowers, the banner opening whitish but rubescent, the inner petals pink or purple. The stems of *D. leucosericea* are usually virgate and little branched below the panicle, the foliage lustrously pilose and silvery at least when young, and the spikes although dense are flexible and hardly conelike. The species is locally common on limestone and pumice soils between 1100 and 1900 m, especially in arid, eroded places, in the valleys of central and northwestern Oaxaca, and extends northeast into the Atoyac-Mixteca lobe of the Balsas depression in southwestern Puebla and adjoining Morelos. The leaves of *D. bacchantum* are densely pilose but greenish, and the spikes are contracted into hard cones. At the only known locality on the volcanic knobs about the village of Tepoztlan in Morelos, *D. bacchantum* is found chiefly on ledges and crevices of volcanic cliffs, where it forms open, freely branching shrubs up to two meters tall. Inflorescences × 1; the rest × 5.

D. leucosericea: 1) top of flowering stem; 2) stipules; 3) bract, ventral view; 4) flower + bract; 5) calyx, laid open; 6) banner, ventral and profile views; 7) androecium; 8) keel; 9) pod.

D. bacchantum: 1) branchlet central and terminal to panicle; 2) stipules; 3) leaflet, dorsal view; 4) flower + bract; 5) calyx, laid open; 6) banner, ventral and profile views; 7) keel; 8) androecium.



DALEA LEUCOSERICEA

XCV

DALEA BACCHANTUM

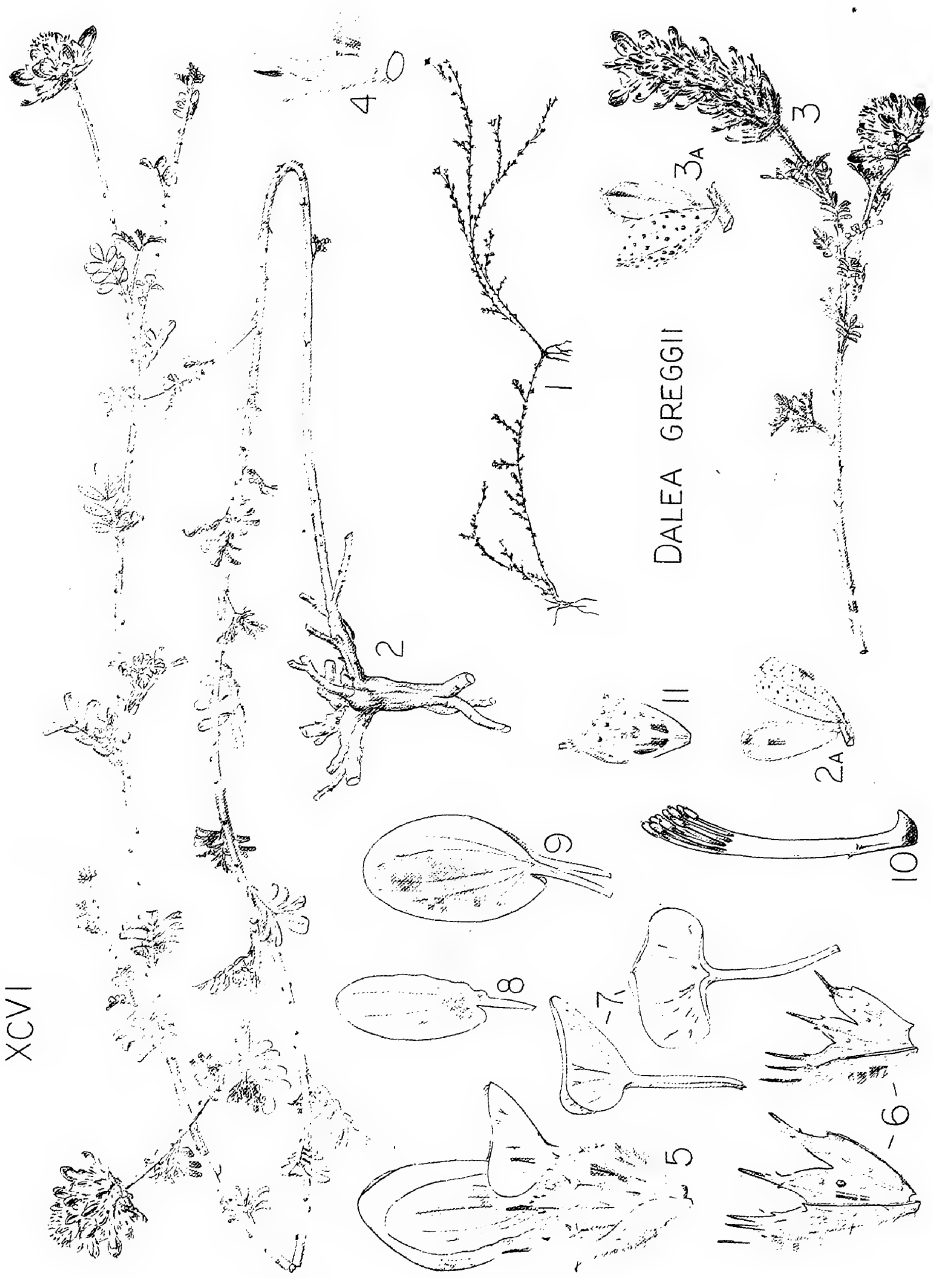

XCVI
DALEA GREGGII
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PLATE XCVI

Dalea greggii Gray, a diffusely branching or procumbent, then often stem-rooting (fig. 1), suffruticulose species widespread over the Mexican Plateau, extending n. into w. Texas, e. to the upper margin of the Gulf Coastal Plain, and s. along the e. edge of the Plateau into Oaxaca. It is strongly calciphile, but has wide altitudinal tolerance, in Zacatecas reaching elevations of ± 2250 m. The foliage is densely pubescent, but the vesture varies from subappressed and silvery (fig. 2, 2a) to villosulous (fig. 3, 3a); the flowers are bicolored, the banner opening yellowish, the rest pale pink to vivid purple-pink. The common form in the arid highlands has silvery leaves and small, few-flowered spikes, this passing, especially at lower levels of Sierra Madre Oriental, into forms with either gray-green, loosely pubescent foliage, or with longer and looser spikes, or these features combined; and in Oaxaca into a form with looser spike and silvery leaves, this closely approaching, except in its always prostrate habit, the allied and sympatric *D. leucosericea*. Flowers of *D. greggii* are produced, in different parts of its range, in all months of the year, but the main crop is expected in the last and first quarters of the year. — Habit-sketch, showing adventitious rooting of the stem, × 1/10; flowering stems × 1; the rest × 5.

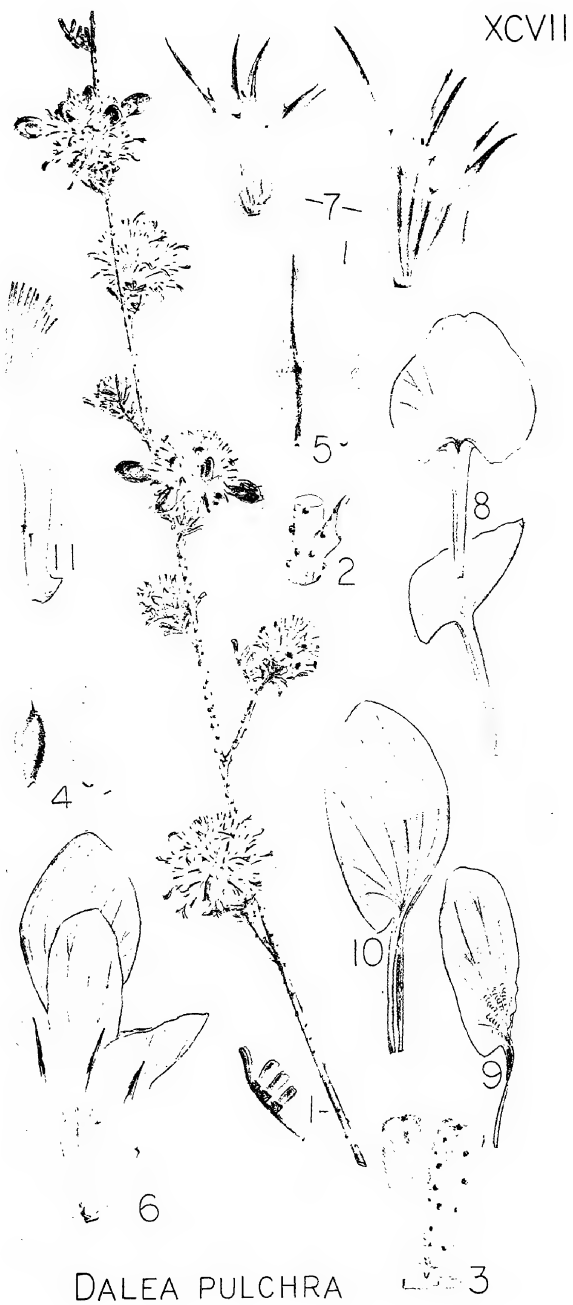
1) Habit-sketch; 2, 2a) flowering stem and leaflets of Plateau form; 3, 3a) do. of lowland form; 4) stipules; 5) flowers; 6) calyces, laid open; 7) banner, profile and ventral views; 8) wing; 9) keel; 10) androecium; 11) pod.

PLATE XCVII

Dalea pulchra Gentry and **D. gypsophila** Barneby both have prominently warty stems, but little else in common. The fully grown plant of *D. pulchra* is a twiggy bush up to 1 m tall and about as broad, its branches scantily clothed with small, drought-deciduous, silvery-pubescent leaves. The many, very dense, subglobose spikes of rose-purple flowers expand in spring (mostly March to May), and the majority are borne on short or subobsolete branchlets axillary to the primary leaves, which form in late summer and are shed during the winter. The range of *D. pulchra* lies in the grama grasslands transitional to oak woodland around the edge of the Sonoran Desert in s. Arizona (Pima and Santa Cruz counties), where it is locally common, and in Sonora, where seldom collected although extending s. to ± 28° N. The dwarf, suffruticose *D. gypsophila* spreads into low, thicket-like patches by means of adventitiously rooting woody branches. It is glabrous below the spikes, but the green, prominently tuberculate leaflets are minutely papillate. The loose flower-spikes are borne aloft on densely leafy stems up to ± 2 dm long; the banner opens yellowish but quickly fades livid, and the inner petals are deep plum-purple. The species is confined to gypseous soils at ± 1850–2100 m in pine-pinyon forest of the Sierra Madre Oriental in the districts of Galeana and adjoining Aramberri, s. Nuevo León, where it flowers intermittently from midsummer onward until frost. — Habit × 1; pod (of *D. gypsophila*) × 10; the rest × 5.

D. pulchra: 1) flowering branch + main cauline leaf; 2) stipules; 3) leaflets; 4) outer bracts, ventral and dorsal views; 5) inner bracts, ventral and dorsal views; 6) flower; 7) calyces; 8) banner, ventral and profile views; 9) wing; 10) keel; 11) androecium.

D. gypsophila: 1) flowering stem; 2) leaflets; 3) bracts, profile and dorsal views; 4) flower; 5) banner, ventral view; 6) wing; 7) keel; 8) androecium; 9) pod.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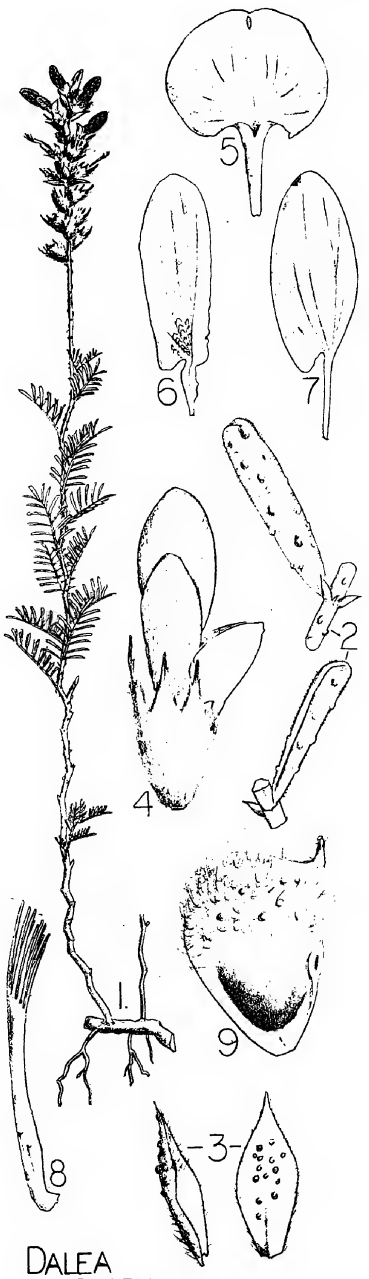
DALEA PULCHRA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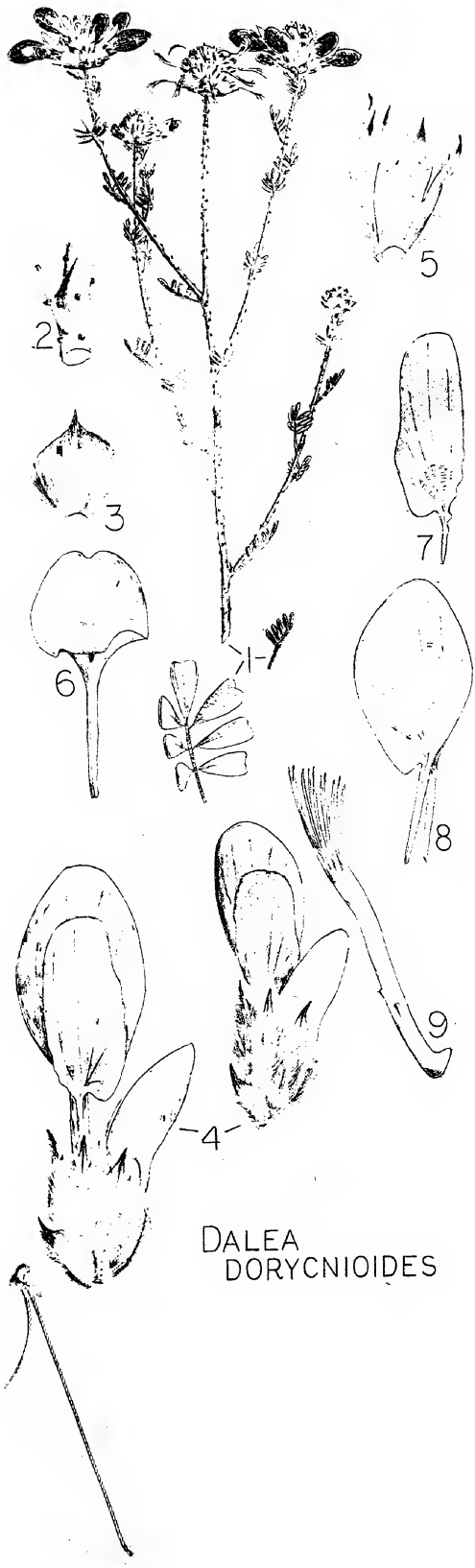
DALEA
GYPSOPHILA

PLATE XCVIII

Dalea dorycnioides DC. and **D. piptostegia** Barneby, small Mexican shrubs of bushy habit, up to 1 m tall but often less, lavishly floriferous in late summer and fall. Features common to both are many repeatedly branching stems, prominently granular-verrucose when young; 2–4 pairs of leaflets; short-toothed, pilosulous but not plumose calyces; and bicolored flowers, the whitish or pale yellow (finally rubescent) banner contrasting with rose-purple wings and keel. Both species vary greatly in density of pubescence; the leaves may be green, gray, or velvety-white, the leaflets small and crowded or larger and separate along the leaf-stalk. The rather common *D. dorycnioides* is at once xerophytic and calciphile, dispersed at ± 1200–2400 m along the intermontane valleys and w. slope of Sierra Madre Oriental from central Nuevo León to Hidalgo, w. through the limestone desert mountains to valley of Río Nazas in n.-e. Durango, and is apparently isolated in central Oaxaca. It has dense, mostly globose, conelike spikes, and each flower is subtended by a broad, firm, persistent bract. The habitally similar *D. piptostegia*, which is known only from andesitic bedrock in the mountains of s.-w. Puebla and immediately adjoining Oaxaca, differs in its longer, looser and therefore soft flower-spikes from which the narrow, submembranous bracts are cast off as the buds expand. — Habit + associated but detached cauline leaves of *D. dorycnioides* × 1; the rest × 5.

D. dorycnioides: 1) top of flowering branchlet + large and small extreme forms of cauline leaf; 2) stipules; 3) bract, ventral view; 4) flowers + bract; 5) calyx, laid open; 6) banner, ventral view; 7) wing; 8) keel; 9) androecium.

D. piptostegia: 1) top of flowering branchlet; 2) stipules; 3) bracts, dorsal view of outer one at left, ventral view of inner one at right; 4) flower + bract; 5) calyx, laid open; 6) banner, ventral and profile views; 7) wing; 8) keel; 9) androecium.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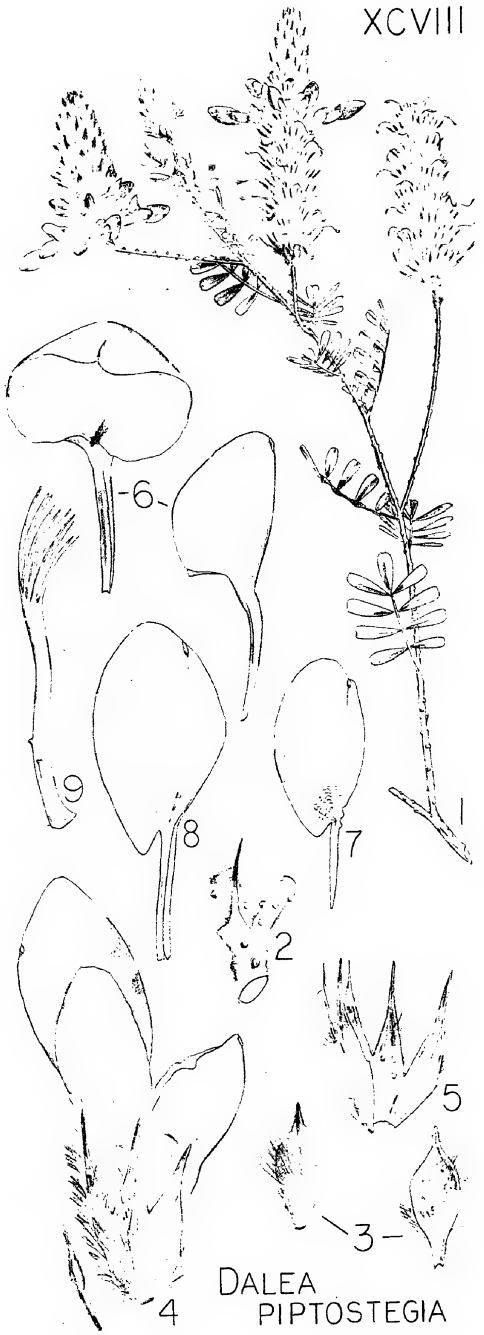
DALEA
DORYCNIOIDES

XCVIII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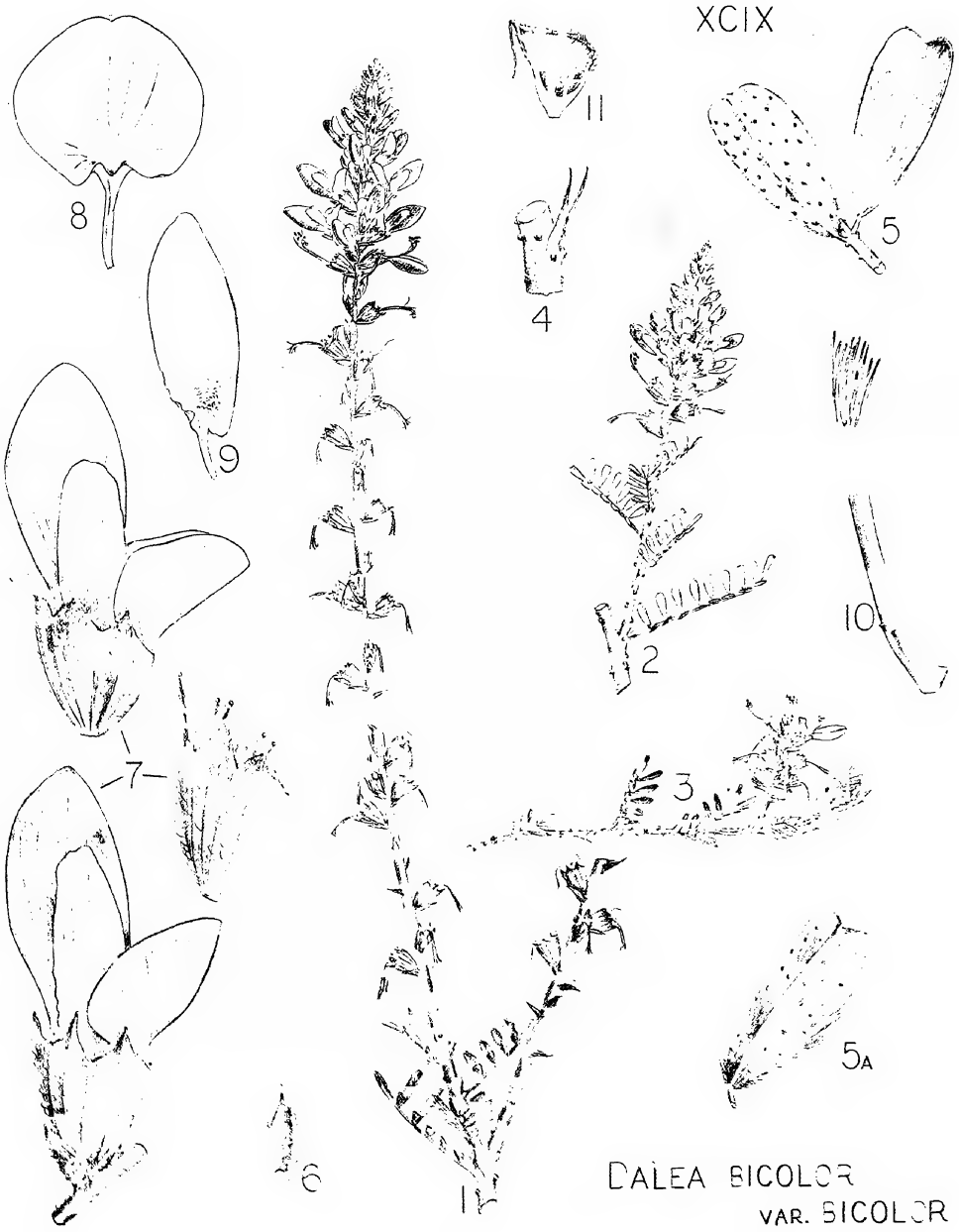
DALEA
PIPTOSTEGIA

PLATE XCIX

Dalea bicolor Humb. & Bonpl. ex Willd. (continued on Plates C–CII) is a polymorphic assemblage of variably frutescent, fruticose or even subarborescent forms of wide dispersal through the temperate and desert regions of Mexico, reaching central Oaxaca s.-ward, western Texas and adjoining New Mexico n.-ward, and represented by endemic races in Baja California, but most abundant on the central Plateau and Sierras Madre. Characters common to all aspects of the species are verruculose stems, leaflets of moderate number never extremely small or fleshy, flowers sessile in the axils of persistent bracts, a relatively short-toothed calyx, and bicolored flowers, the banner opening whitish or pale yellow, the epistemonous petals pink, purple, less often violet or vivid blue. The var. **bicolor**, the variety dominant over the Mexican Plateau, presents so many aspects of stature, pubescence, leaflet-number, and flower-color, that no one plate can do it justice. The plants vary according to habitat from creeping, thymelike shrublets (fig. 3) found on the pumice plains in the foothills of Orizaba, through increasingly tall and bushy stature to treelets as much as 4 meters tall. The spike is usually loose, the calyces not so crowded as to conceal the central axis, but varies enormously in length; leaves may be green and minutely villosulous or ashen with loose dense hairs; calyx-teeth vary from deltate to triangular-acuminate; and all these variables may be combined in different ways. — Flowering branchlets × 1; the rest × 5.

1, 2, 3) branchlets with inflorescences of different lengths and densities; 4) stipules; 5, 5a) leaflets; 6) bract, ventral view; 7) flowers and calyces; 8) banner, ventral view; 9) wing; 10) androecium; 11) pod.


XCIX
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DALEA BICOLOR
VAR. BICOLOR

PLATE C

Dalea bicolor var. **canescens** (Mart. & Gal.) Barneby and var. **argyrea** (Gray) Barneby are geographic races of a polymorphic species illustrated in Plates XCIC–CII; see caption to the first of these. The var. *canescens*, restricted in typical form to the calcareous Tehuacán desert in Puebla and immediately adjacent Oaxaca, has silky-pubescent foliage and relatively few (1–3) pairs of leaflets. The var. *argyrea*, likewise calciphile, with velvety- or satiny-pilosulous foliage and calyces but more numerous (mostly 3–6) pairs of leaflets, ranges through the Sierra Madre Oriental from southwestern Tamaulipas north through floristically related mountains of Coahuila into trans-Pecos Texas and the Guadalupe Mountains in southern New Mexico. Both varieties have rose-purple or pink inner petals; both intergrade with var. *bicolor*. Inflorescences × 1; the rest × 5.

var. *canescens*: 1) branchlet; 2) stipules; 3) bracts, ventral and dorsal views; 4) flower + bract; 5) banner, ventral view; 6) keel; 7) androecium.

var. *argyrea*: 1) branchlet; 2) leaflets; 3) bract, ventral view; 4) flower; 5) androecium + keel.

PL. C

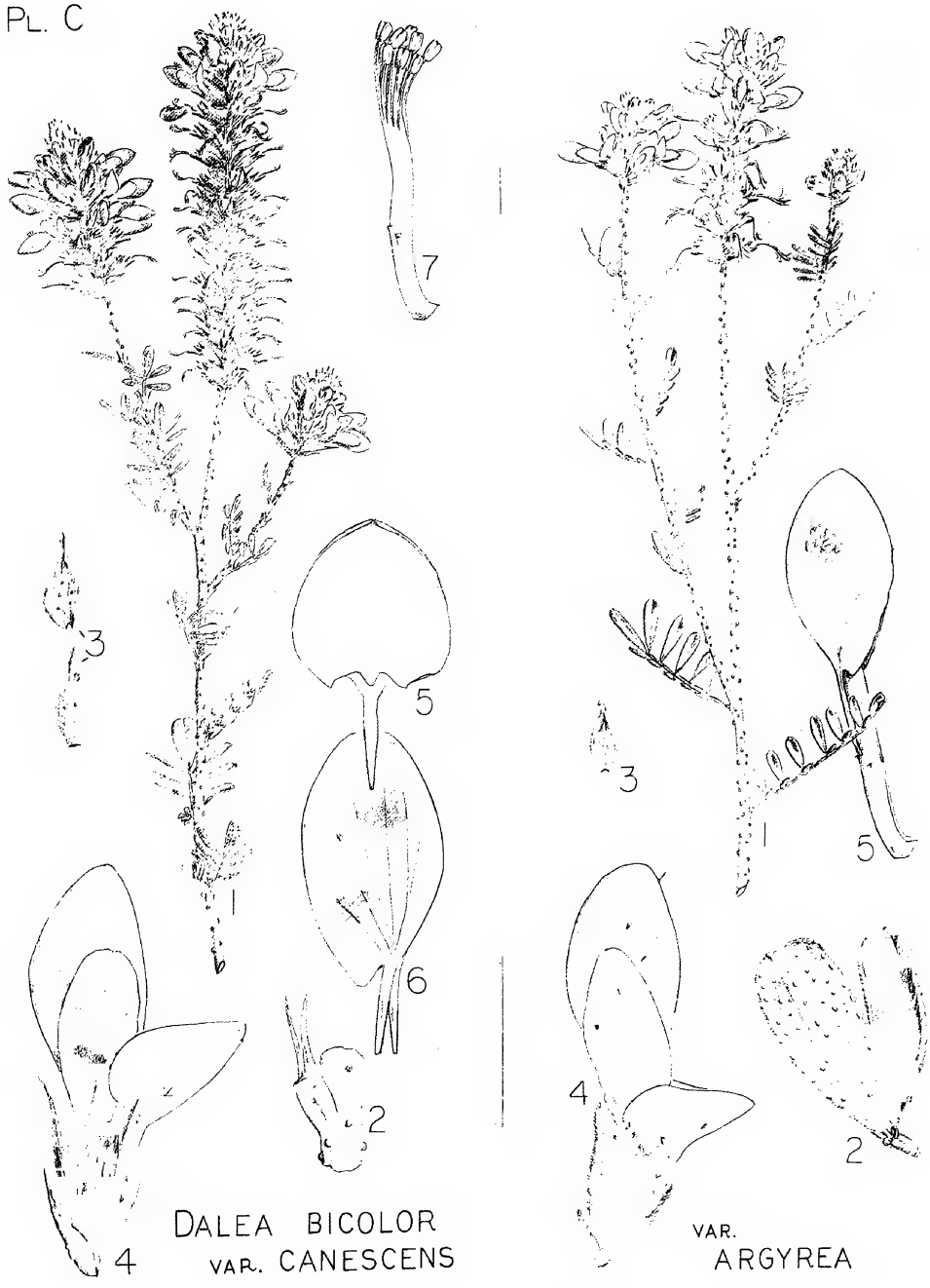
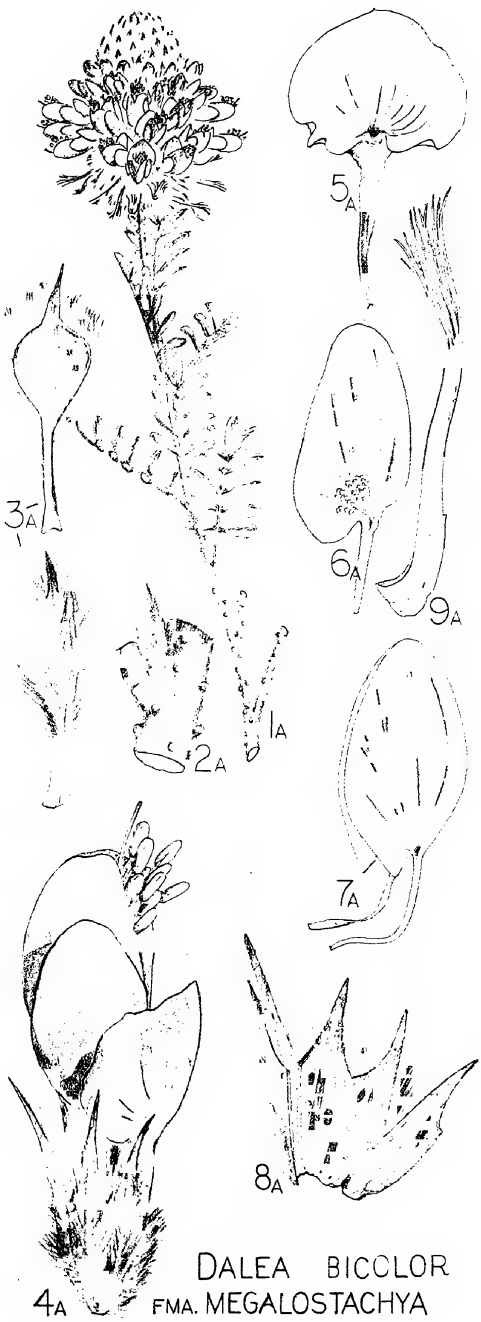


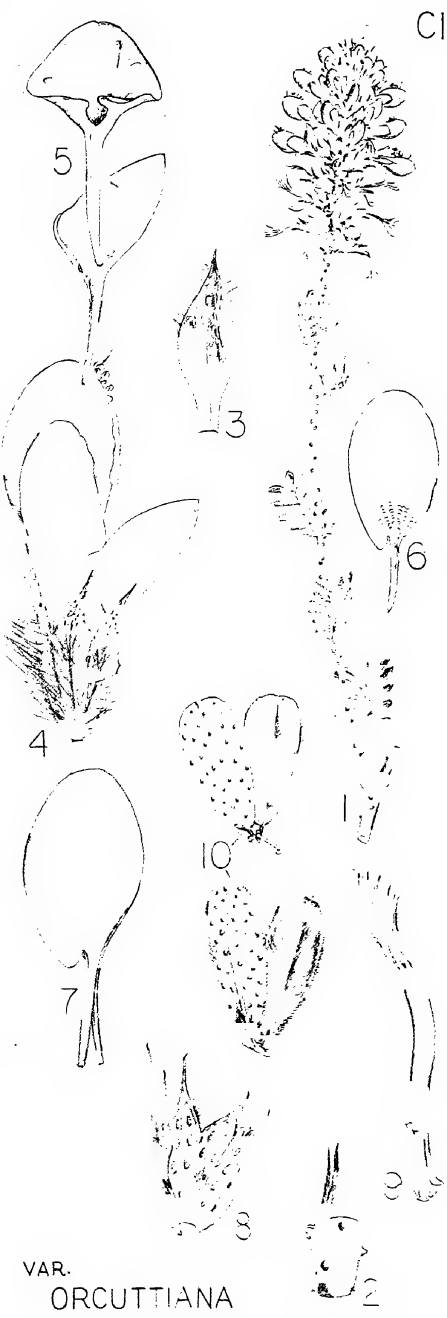
PLATE CI

Dalea bicolor var. **orcuttiana** Barneby, the representative in Baja California of a polymorphic species (cf. Pl. XCIX–CII) widespread over the Mexican Plateau. It is a shrub up to ± 1 m tall, with warty stems, foliage either gray-tomentulose or green and thinly puberulent, and rose-purple flowers, several tiers of which often expand simultaneously, rendering the spikes exceptionally ornamental. The flower-spike of var. *orcuttiana* varies in length, diameter, and density, the fma. **megalostachya** (Brandg.) Barneby being the state in which the largest flowers, separated by oblanceolate bracts, are crowded into an ovoid or subglobose cone; the plant figured at right with looser spike of smaller calyces separated by ovate bracts is much commoner and occurs through the whole range of the variety, from Sierra San Pédro Mártir s. to Sierra Giganta. A notable feature of var. *orcuttiana* is the long tassel of filaments, often shortly exserted from the keel. The plants flower irregularly, either in spring, fall, or winter, anthesis being more capricious s.-ward under extreme desert conditions. — Flowering branchlets × 1; the rest × 5; figs. followed by a = fma. *megalostachya*.

1) flowering branchlets; 2) stipules; 3) bracts; 4) flowers; 5) banners; 6) wings; 7) keels; 8) calyces, laid open; 9) androecia; 10) leaflets, top puberulent dorsally, bottom, silky both sides.



DALEA BICOLOR
FMA. MEGALOSTACHYA



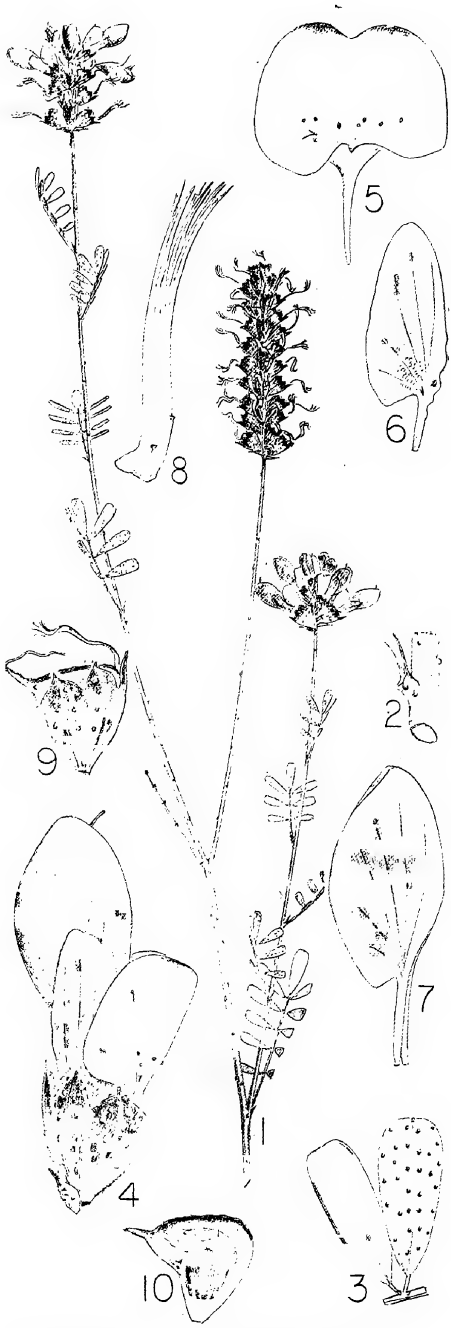
VAR.
ORCUTTIANA

PLATE CII

Dalea bicolor var. **naviculifolia** (Hemsl.) Barneby and **D. choanosema** Barneby are much alike in their puberulent stems and foliage, in their short-toothed calyces subtended by little persistent bracts, and in their bicolored flowers, the banner opening whitish, the wings and keel purple. The var. *naviculifolia*, an endemic Oaxacan variety of the widely dispersed, shrubby Mexican species further illustrated in Plates XCIX–CI, is diffusely or bushily branched from a fruticose base, and differs from other forms of *D. bicolor* in its small flower combined with relatively small and many, boat-shaped leaflets. It inhabits the pine forests of Mixteca Alta at ± 1950–2250 m, flowering from mid-September into December or later. The stems of *D. choanosema*, known only from pine-oak woodland at 2250 m in Sierra Madre del Sur near Chilpancingo, Guerrero, flowering in late fall and early winter, are entirely herbaceous, virgate, up to a meter tall, less densely gland-tuberculate than most forms of *D. bicolor*, and branch distally into an open panicle of spikes. Note the ample banner, closed at base into a deep, rather open cornet, and charged at the eye with a sprinkle of beadlike glands. — Habit × 1; the rest × 5.

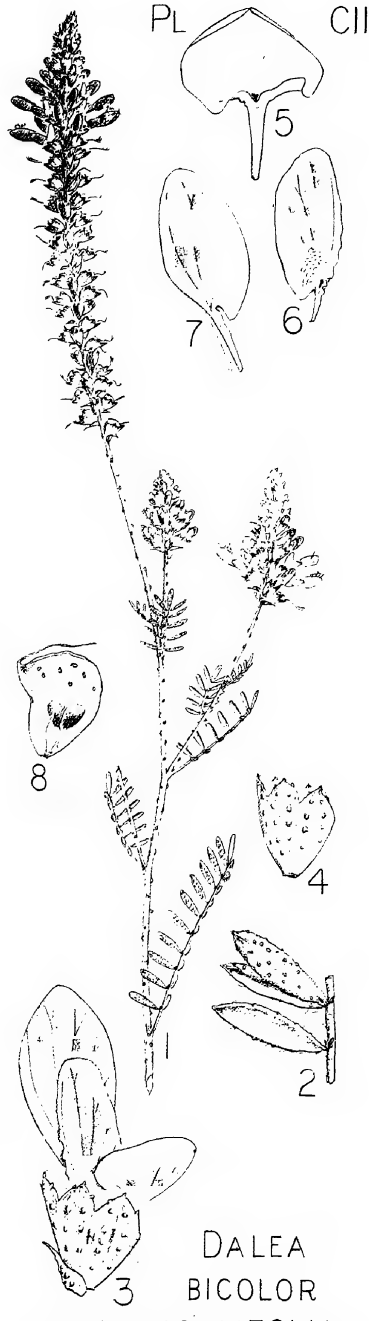
D. bicolor var. *naviculifolia*: 1) flowering branchlet; 2) leaflets; 3) flower + bract; 4) calyx, an externally glabrous form; 5) banner; 6) wing; 7) keel; 8) pod.

D. choanosema: 1) division of the panicle; 2) stipules; 3) leaflets; 4) flower + bract; 5) banner, ventral view; 6) wing; 7) keel; 8) androecium; 9) fruiting calyx; 10) pod.



DALEA CHOANOSEMA

PL CII



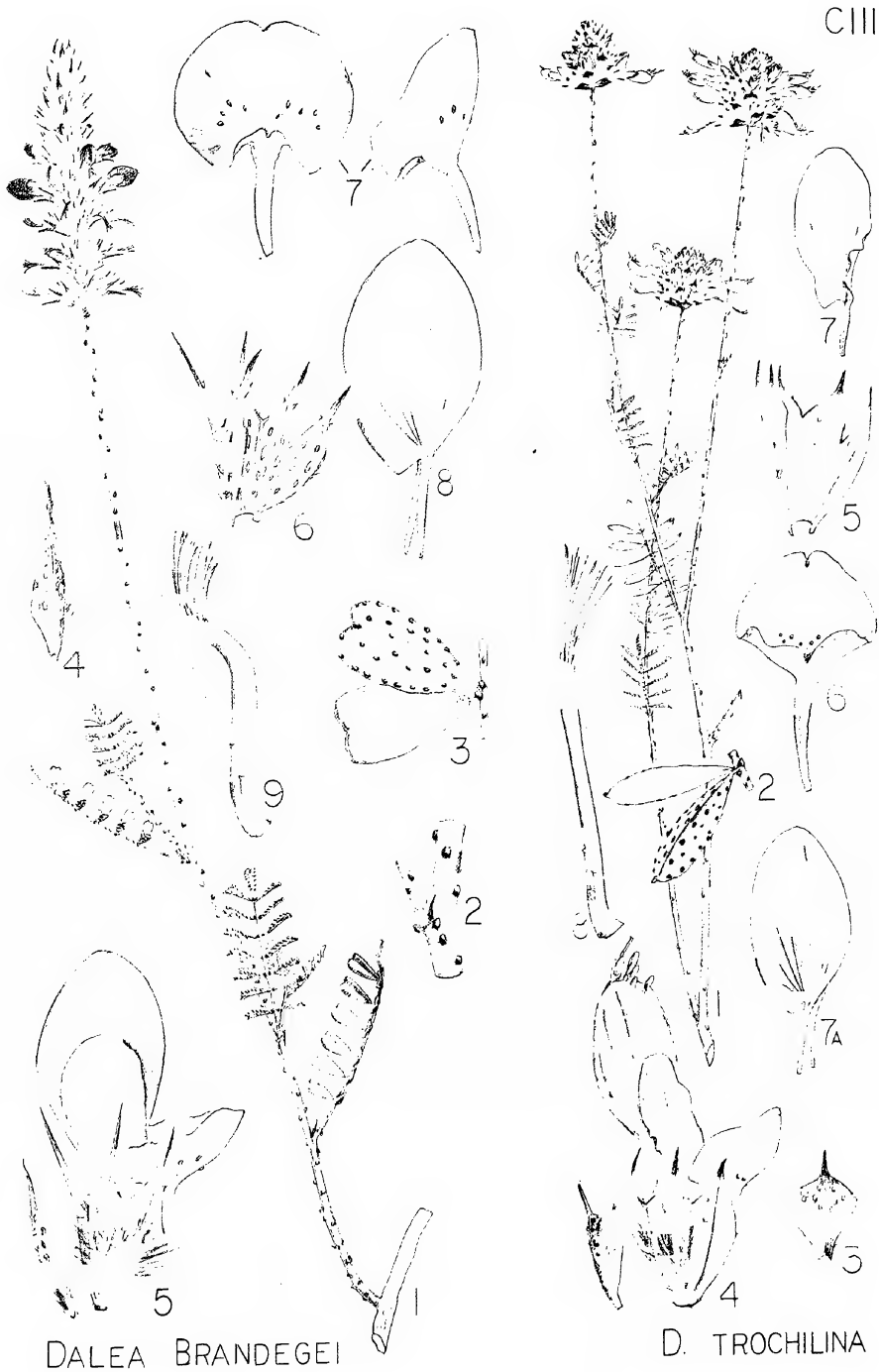
DALEA BICOLOR VAR. NAVICULIFOLIA

PLATE CIII

Dalea brandegei (Rose) Bullock and **D. trochilina** Bdg. are rare species, endemic to Baja California Sur, the former native to fog desert below 50 m around Bahía Magdalena (near lat. 24° 30′ N), the latter to oak-pine or oak-madroño woodland above 1400 m in the sierras of the Cape (near lat. 23° 30′ N). They are closely related, alike in the coarsely warted, early frutescent stems, glabrous foliage, and bicolored flowers, bright purple except for the banner that opens creamy and fades plum-color. The highly xerophytic, drought-deciduous *D. brandegei*, pictured here in its short-lived leafy phase, has obcordate leaflets, a spike only moderately dense, and relatively long calyx-teeth. It forms low shrubs with crooked gray older branches, and flowers following rains between October and April. The taller *D. trochilina* can bear flowers as a suffruticose herb but eventually becomes shrubby, with virgate trunk and a panicle of more pliant branches that can reach a stature of 3 m. Its leaflets are oblanceolate, not notched at tip, its spike is dense and conelike, and its calyx-teeth are short. It has been collected in flower at intervals between November and May and perhaps is in active growth during most of the year. — Habit × 1; the rest × 5.

D. brandegei: 1) flowering branchlet; 2) stipules; 3) leaflets; 4) bract, ventral view; 5) flower + bract; 6) calyx, laid open; 7) banner, ventral and profile views; 8) keel; 9) androecium.

D. trochilina: 1) branch of panicle; 2) leaflets; 3) bract, ventral view; 4) flower + bract; 5) calyx, laid open; 6) banner, ventral view; 7) wing; 7a) keel; 8) androecium.


CIII
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DALEA BRANDEGEI
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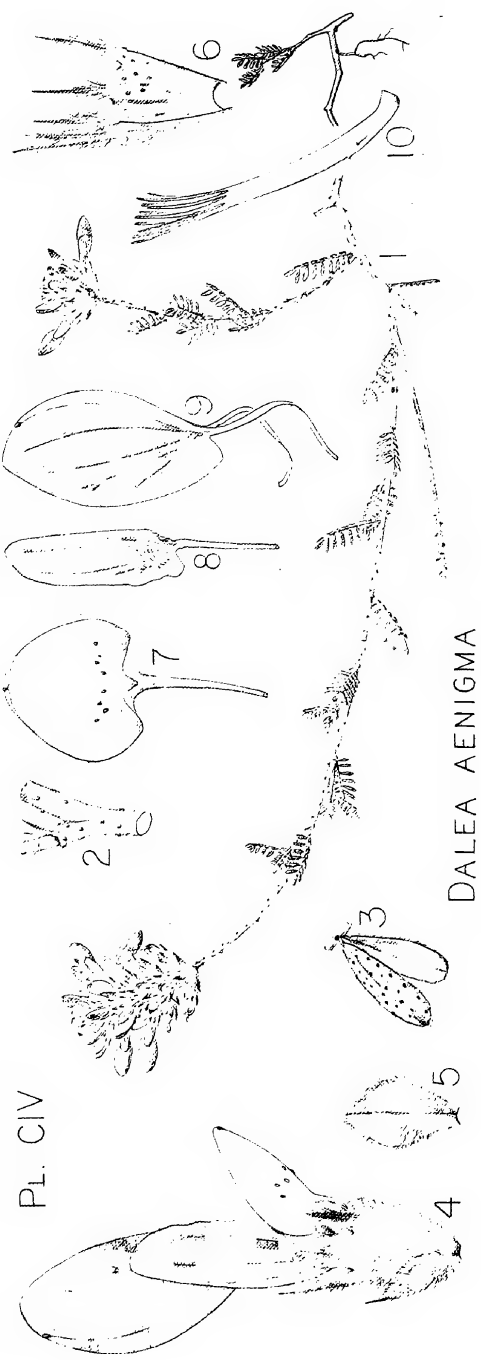
7A
4
3
D. TROCHILINA


PL. CIV
DALEA AENIGMA
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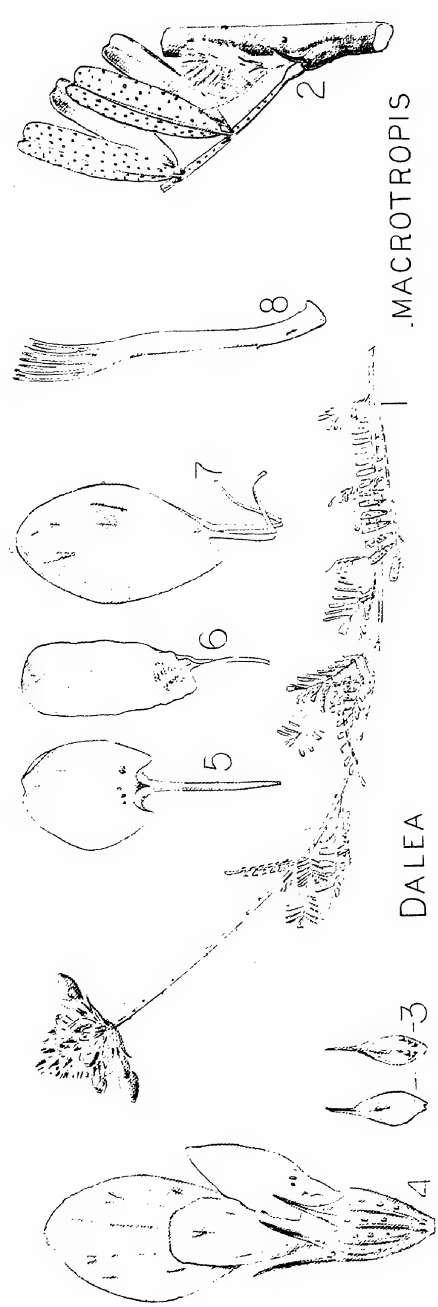
DALEA
MACROTROPIS
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PLATE CIV

Dalea aenigma Barneby and **D. macrotropis** Schauer, small diffuse suffruticulose daleas with warty stems, neat greenish or glaucescent foliage, and bicolored flowers, the proportionately large, far exserted purple keel contrasting with a cream-yellow (but in age rubescent), gland-sprinkled banner. The finely pilosulous *D. aenigma*, which flowers in midsummer on the plateau between the valley of México and s. Hidalgo, has radicant stems, axillary short-shoots no more densely hairy than primary leaves, and densely pilose calyces. The ambiguous *D. macrotropis*, for which no exact locality within Mexico is on record, has glabrous stems and glabrous, glaucescent primary leaves subtending densely silky short-shoots; its full stature is unknown, but it seems not to be radicant and differs further from *D. aenigma* in its thinly pilosulous calyx. — Habit × 1; the rest × 5.

D. aenigma: 1) habit; 2) segment of stem + stipules; 3) leaflets; 4) flower + bract; 5) bract, ventral view; 6) calyx, laid open; 7) banner, ventral view; 8) wing; 9) keel; 10) androecium.

D. macrotropis: 1) top of stem; 2) base of a primary cauline leaf + axillary short-shoot; 3) bract, ventral and dorsal views; 4) flower; 5) banner, ventral view; 6) wing; 7) keel; 8) androecium.

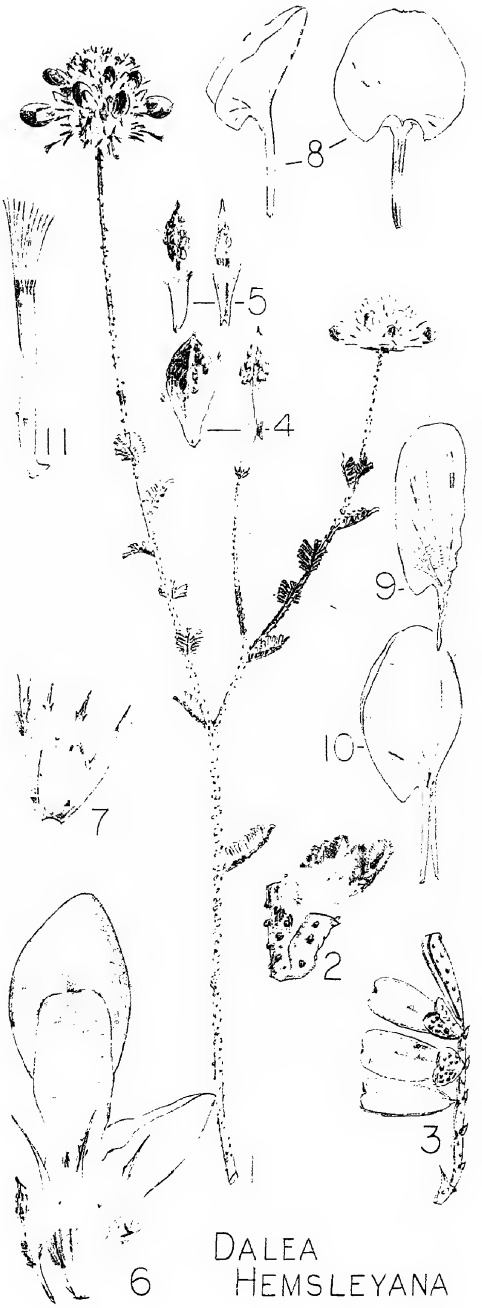
PLATE CV

Dalea hemsleyana (Rose) Bullock and **D. polycephala** (Rydb.) Bullock are small bushes, rarely a meter tall, with wiry, densely warted stems, condensed green foliage of thick texture, and bicolored flowers, the banner opening creamy but rubescent, the inner petals rose or purple. Both are adapted to long periods of drought, when the larger stem leaves are shed; flowers appear in fall, long after the yearly rains are spent. The more southern species, *D. polycephala*, ranges at elevations between 2000 and 2800 m from central Puebla and the Valley of Mexico n. across the pumice plains on the west slope of Mt. Orizaba and Cofre de Perote and the desert grasslands of Hidalgo into southeastern San Luis Potosí. The adult foliage is generally glabrous southward but tends to be puberulent toward the northern limit. Note the 2–4 pairs of tiny leaflets, the loose spike, and deciduous bracts. The gland-tipped inner petals are mostly pale pink and relatively small. The rarer and more showy *D. hemsleyana* is found in elevated steppe at ± 2100–2450 m on the Meseta Central in Zacatecas and s.-w. San Luis Potosí. The foliage is ordinarily glabrous, but the deciduous main cauline leaves subtend late in the season silvery-pubescent buds some of which may develop into short spurs or branchlets. The leaflets are mostly 4–7 pairs, the dense, conelike spikes retain through anthesis an involucel of dorsally glabrous bracts, and the glandless petals are vivid purple. — Flowering branches × 1; the rest × 5.

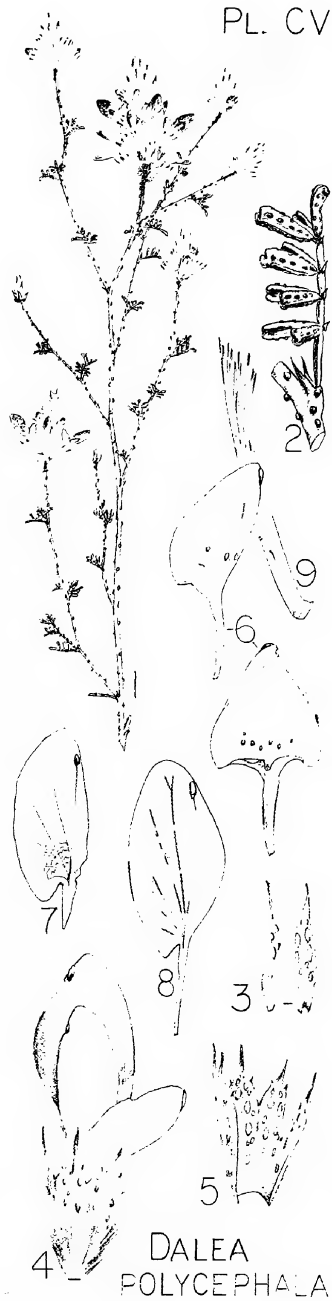
D. hemsleyana: 1) branch; 2) leaf-spur + incipient villosulous spur; 3) leaf (some leaflets removed); 4) outer bracts, dorsal and ventral views; 5) inner bracts; 6) flower; 7) a calyx, laid open; 8) banner, profile and ventral views; 9) wing; 10) keel; 11) androecium.

D. polycephala: 1) branch; 2) leaf; 3) bract, profile and ventral views; 4) flower; 5) calyx, laid open; 6) banner, profile and ventral views; 7) wing; 8) keel; 9) androecium.

PL. CV



DALEA HEMSLEYANA



DALEA POLYCEPHALA

PLATE CVI

Dalea capitata Wats., a diffuse, tortuously twiggy, xerophytic shrublet rarely reaching 5 dm in height but often twice as broad, may be either glabrous below the silky calyces or thinly and minutely pilosulous on the young branchlets. The small, commonly thick-textured leaflets vary from bright green to glaucous, and are punctate either beneath or on both sides. The petals vary from pale yellow to bright golden yellow, turning reddish or orange as they fade. The species is confined to calcareous and gypseous soils and is found in widely scattered localities on the Mexican plateau and in the northern Sierra Madre Oriental between approximately the Tropic of Cancer in Zacatecas and southwest Tamaulipas and the latitude of Saltillo in southern Coahuila. Within this area it has broken up into at least four varieties, distinguished by number of flowers, size of bracts, and features of the calyx (for details, see the text). Flowering branchlets × 1; the rest, except where noted, × 5.

var. *capitata*: 1) branchlet; 2) stipules; 3) leaflets; 4) bracts, dorsal and ventral views; 5) flower + bract; 6) banner; 7) wing; 8) keel; 9) androecium.

var. *quinqueflora* (Bdg.) Barneby: 10) branchlets; 11) stipules + base of leaf-stalk × 10; 12) leaflets; 13) bract, ventral view; 14) flower + bract; 15) calyx, laid open; 16) banner; 17) wing; 18) keel; 19) androecium; 20) pod.

var. *pseudo-hospes* Barneby: 21) leaflets; 22) flower + bract; 23) calyx, laid open.

var. *lupinocalyx* Barneby: 24) leaflets; 25) flower + bract; 26) calyx, laid open.

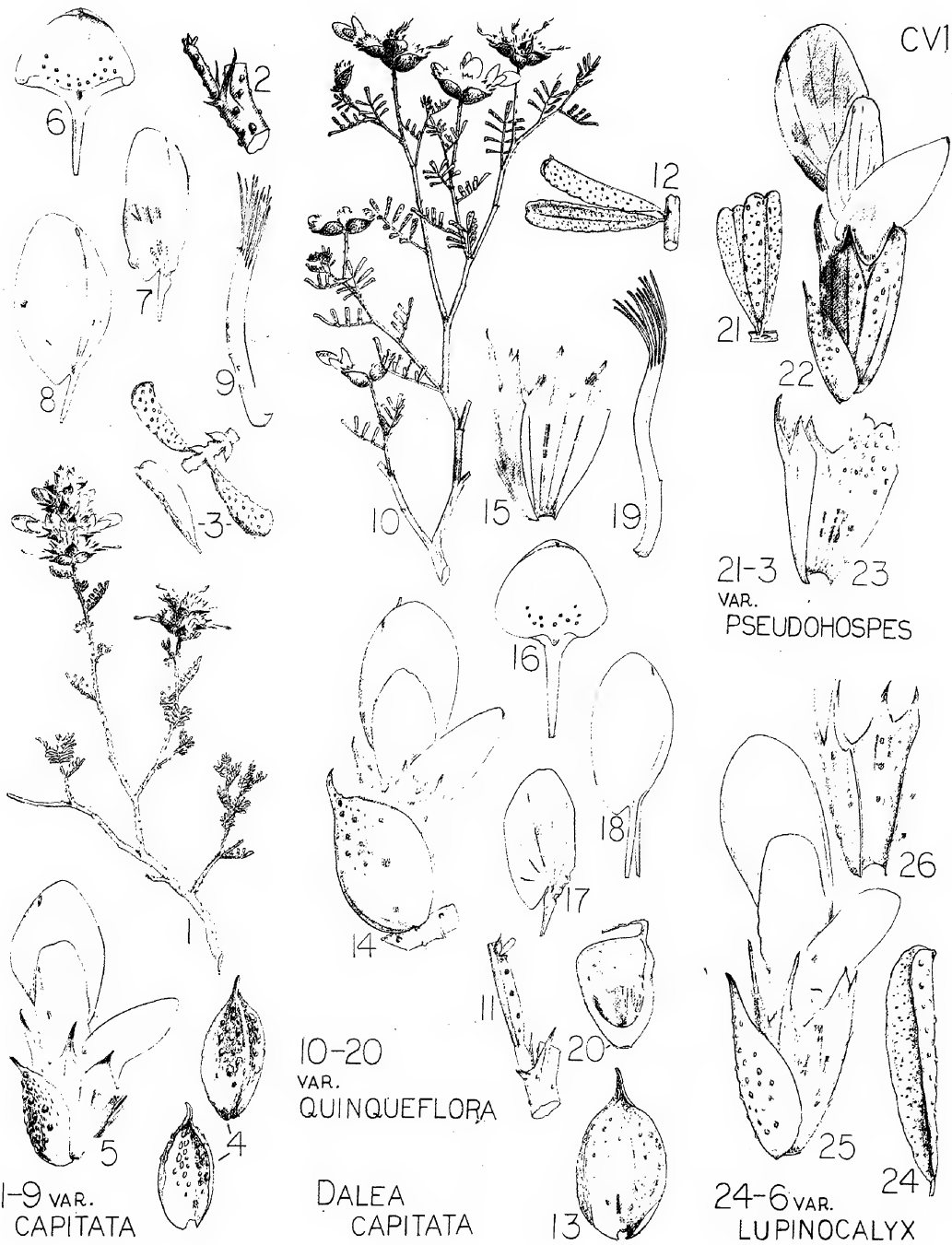
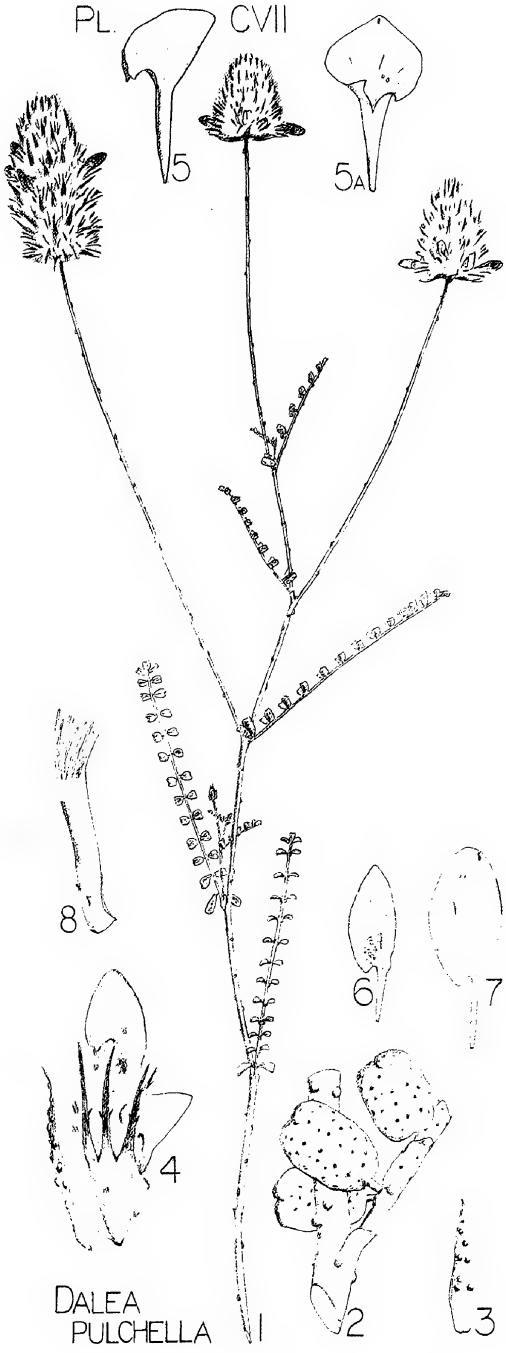

CV1
1-9 VAR.
CAPITATA
DALEA
CAPITATA
10-20
VAR.
QUINQUEFLORA
21-3
VAR.
PSEUDOHOSPES
24-6 VAR.
LUPINOCALYX

PLATE CVII

Dalea pulchella G. Don and **D. cuniculo-caudata** P. G. Wilson, highly localized Mexican daleas with glabrous stems and foliage, numerous small leaflets of fleshy texture, and dense heads of silky-pilose, relatively long-toothed calyces. The plants of *D. pulchella* mature rapidly, sometimes flowering during the first season and then appearing monocarpic, but eventually become suffruticose and up to 1.5 m tall; the stems are prominently warty, slender and wiry, the epistemonous petals purple or violet contrasting with a small white (early rubescent) banner. The foliage is unique, the small round fleshy leaflets arranged far apart along the stiff leaf-stalks, the lowest pair quaintly larger than the rest, and all punctate on both sides. This is one of several rare winter-flowering daleas of the Pacific slope, known only from the Sierra Madre on the Sinaloa-Durango border and in the mountains of w. Jalisco, growing in pine-oak woodlands at 1500–2200 m. The technically similar but probably not closely related *D. cuniculo-caudata* is known only from the wooded foothills around the s.-w. base of Nevado de Toluca, at ± 1200–1900 m in s.-w. México and adjoining Michoacán. Its slenderly virgate, smooth, often solitary stems branch distally into a panicle of spikes, and the foliage is more commonplace, green and dotted only on the lower side. Notable features of *D. cuniculo-caudata* are extremely brittle stems, not known in any other dalea, interfloral bracts lined with silky hairs, and epistemonous petals usually vivid blue. — Habit × 1; the rest × 5.

D. pulchella: 1) branch of panicle; 2) segment of stem and lower leaflets of cauline leaf; 3) lower bract; 4) flower + interfloral bract; 5) banner, profile view; 5a) the same, ventral view; 6) wing; 7) keel; 8) androecium.

D. cuniculo-caudata: 1) branch of panicle; 2) stipules; 3) outer bract; 4) flower + interfloral bract; 5) banner, ventral view; 6) wing; 7) keel; 8) segment of leaf-rachis + petiolules; 9) leaflets, back and front; 10) androecium.


PL. CVII
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5A
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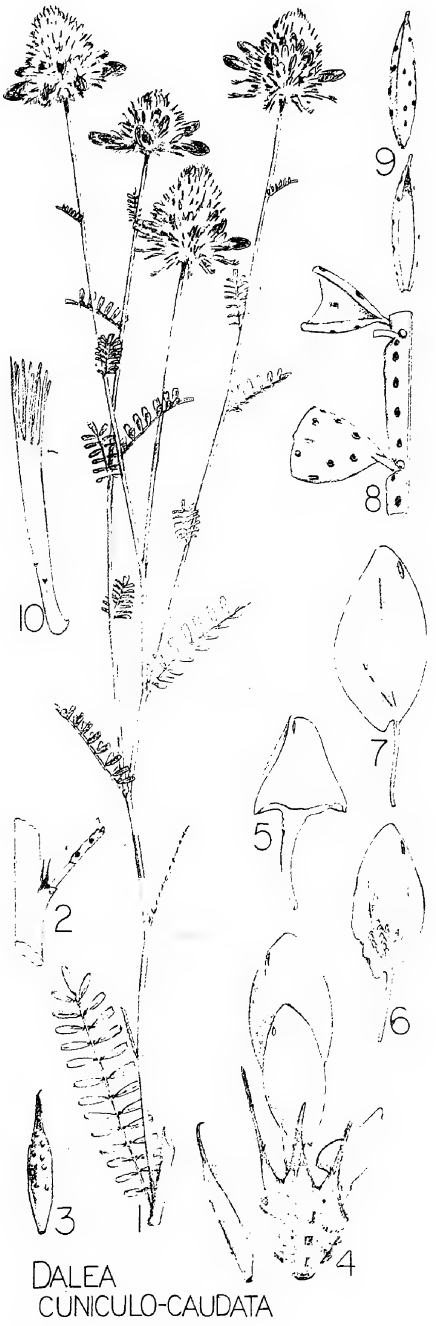
DALEA
PULCHELLA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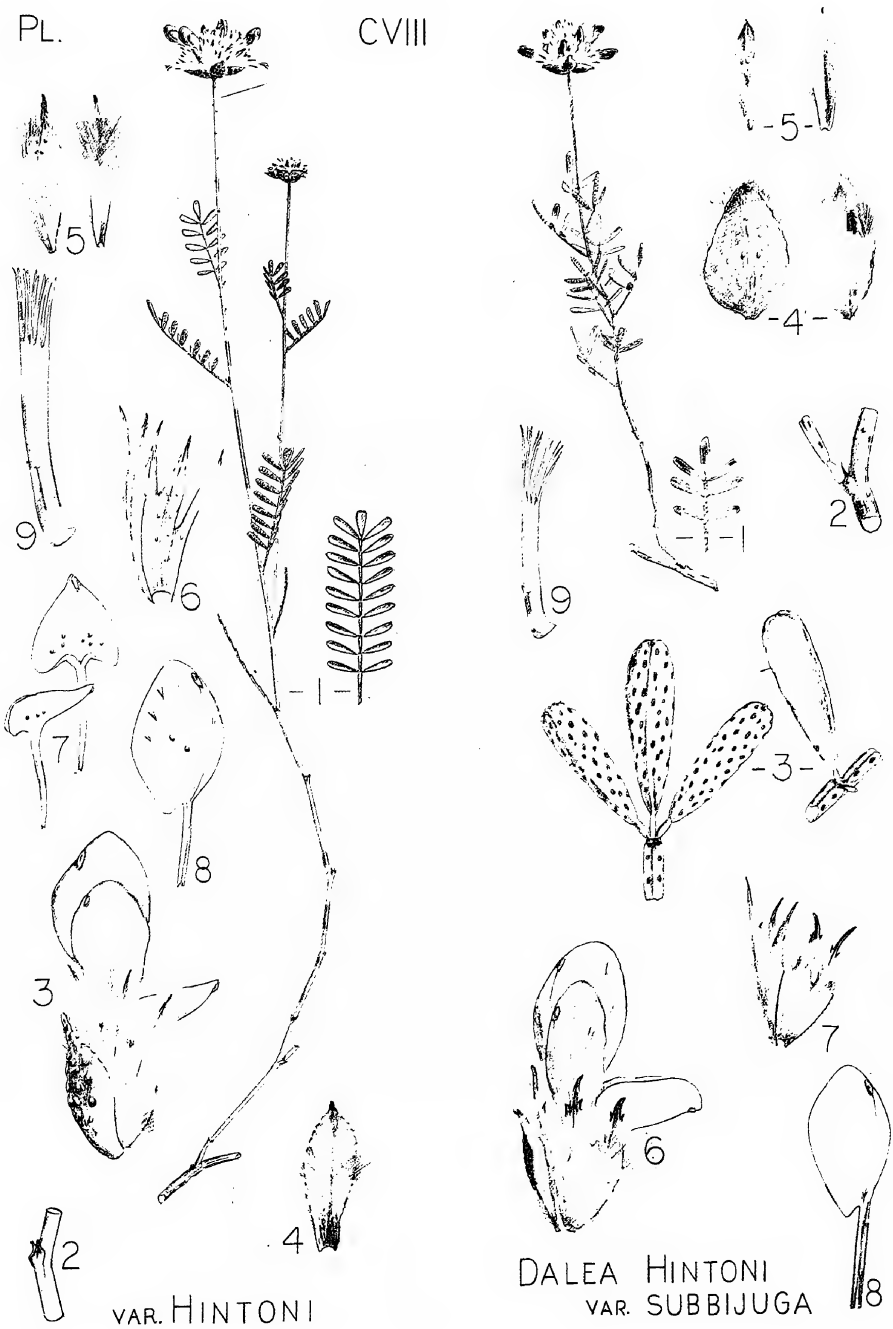
DALEA
CUNICULO-CAUDATA

PLATE CVIII

Dalea hintoni Sandwith var. **hintoni** and var. **subbijuga** Barneby, together with var. **aldamana** Barneby (Plate CIX), three highly localized races of a rare dalea found hitherto only in s.-w. Edo. de México and Guerrero, the first two in pine-oak woodland above 1000 m, the last in arid grassland at ± 400 m, where they flower primarily in the dry season. All are perennial and suffruticose, glabrous to the headlike spikes of bicolored (white and purple) flowers, which are subtended by persistent, inwardly silky bracts. The pineland varieties illustrated here are lowly plants, the mostly monocephalous stems rising less than 4 dm from the forest floor, although the main stems may be prostrate and much longer. They differ mainly in leaflet-number, var. *hintoni*, of Temascaltepec district in Mexico, having at least six pairs in most leaves, whereas var. *subbijuga*, of Sierra Madre del Sur in Guerrero, has at most four and usually only two or three. In both, however, the leaf is petioled. The var. *aldamana*, of the Balsas valley in Mina district in Guerrero, is a taller plant, with virgate, distally branching stems up to 1 m tall; its sessile leaves have 9–15 pairs of leaflets. — Inflorescences × 1; the rest × 5.

var. *hintoni*: 1) flowering branchlet + detached cauline leaf; 2) stipules 3) flower + lower bract; 4) lower bract, ventral view; 5) interfloral bract, dorsal and ventral views; 6) calyx, laid open; 7) banner, profile and ventral views; 8) keel; 9) androecium.

var. *subbijuga*: 1) flowering branchlet; 2) stipules; 3) leaflets, 3 dorsal view, 1 ventral; 4) outer bract, dorsal and ½profile views; 5) inner bract, dorsal and ventral views; 6) flower + inner bract; 7) calyx, laid open; 8) keel; 9) androecium.


PL. CVIII
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VAR. HINTONI
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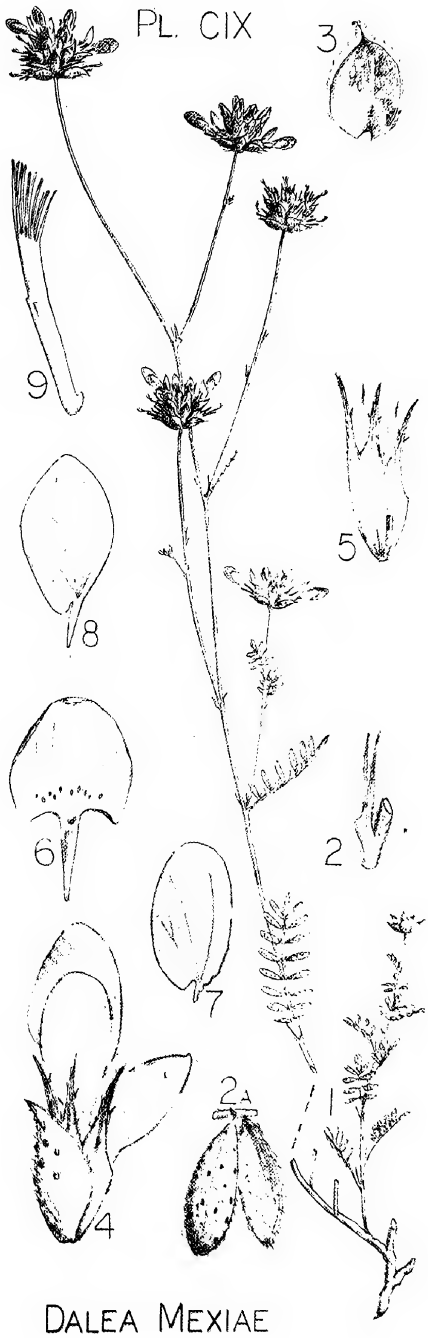
8
DALEA HINTONI
VAR. SUBBIJUGA

PLATE CIX

Dalea hintoni var. **aldamana** Barneby and **D. mexiae** Barneby, rare daleas of southern Mexico, the former a variety of a species more fully illustrated on Pl. CVIII, q. v. for comment. The slender suffruticose *D. mexiae* is known from only two localities in western Jalisco, where it was found in oak-pine forest at ± 2500 m, flowering in February. The ascending stems reach a length of ± 3.5 dm, the foliage is silkily gray-pilosulous, and the petals are bicolored, the ample plane banner opening white but rubescent, the high-perching, short-clawed wings and keel rose-purple. The capitate spikes, persistent bracts, short-toothed calyx glabrescent toward the base and strongly oblique at mouth, and the mutual proportions of banner to epistemonous petals together characterize this ornamental species. — Stems × 1; the rest × 5.

D. hintoni var. *aldamana*: 1) top of flowering stem; 2) stipules + base of leaf-stalk; 3) leaflets; 4) bracts, dorsal and ventral views; 5) flower + bract; 6) calyx, laid open; 7) banner, profile and ventral views; 8) wing; 9) keel; 10) androecium.

D. mexiae: 1) habit; 2) stipules; 2a) leaflets; 3) bract, ventral view; 4) flower + bract; 5) calyx; 6) banner, ventral view; 7) wing; 8) keel; 9) androecium.



DALEA MEXIAE

D. HINTONI
VAR ALDAMANA

PLATE CX

Dalea saffordii (Rose) Bullock and **D. eriophylla** Wats. are not close relatives, but are endemic neighbors on the dry eastern slope of Sierra Madre Oriental and outlying limestone ranges in s. Coahuila, n. San Luis Potosí, and adjoining Nuevo León. Both are shrubby, strongly calciphile, and adapted to extremes of drought, and have been collected in flower in fall and spring. The banner in both opens white, fading purplish, the inner petals rose or violet-purple from the first. The relatively tall *D. saffordii* forms twiggy shrubs up 5–15 dm tall, with livid branchlets and glabrous, drought-deciduous leaves. The diminutive shrubs of *D. eriophylla*, instantly recognized by the small trefoil leaves, are only 1–3 dm tall and as much across, and the few-flowered spikes are sessile at the tips of the many, intricately branching twigs. In var. **eriophylla**, which occupies the whole range of the species, the plant is white-tomentulose everywhere except for the glabrous inner faces of the bracts and stipules, and the calyx is pilosulous from the base upward. In var. **frankenioides**, known only from one station in n. San Luis Potosí, the stems are tomentulose but the leaves and tube of the calyx are glabrous, while the pubescence of the bracts and stipules is reversed, absent externally but silky within. — Habit × 1; the rest × 5.

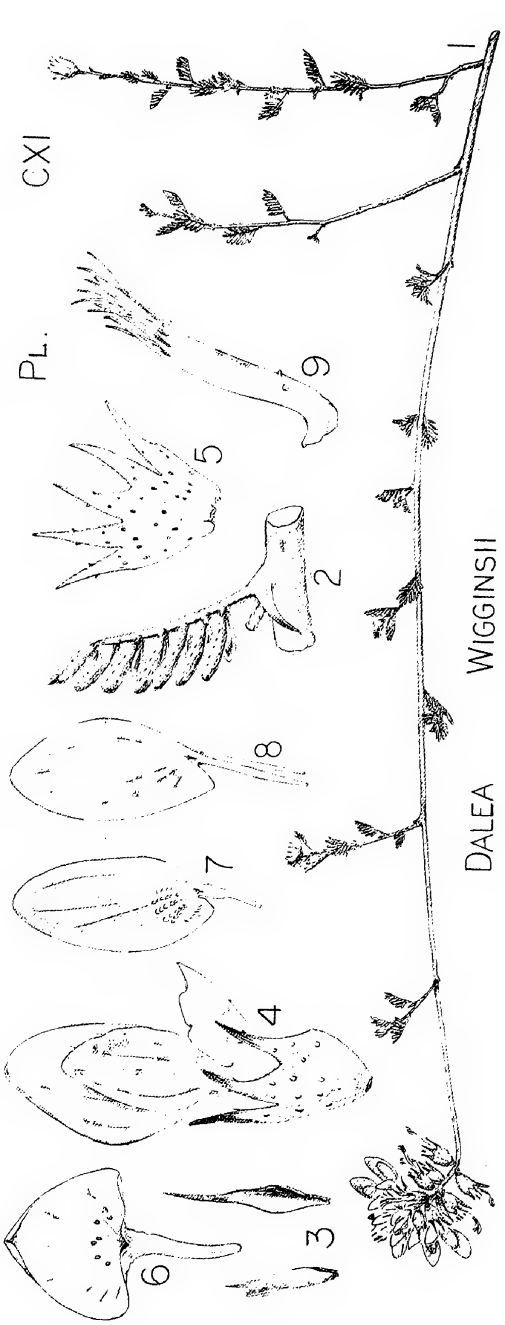
D. saffordii: 1) spring-flowering branch, with heads terminal to axillary branchlets; 2) stipules; 3) leaflets; 4) bracts, dorsal view, the outermost at right, the inner at left; 5) flowers; 6) calyx, laid open; 7) banner, ventral view; 8) wing; 9) keel; 10) androecium.

D. eriophylla var. *eriophylla*: 1) branchlet; 2) leaf; 3) bract ventral view; 4) flower; 5) banner, ventral and profile view; 6) wing; 7) keel; 8) androecium.

D. eriophylla var. *frankenioides*: 1a) branchlet; 2a) stipules, lateral view; 3a) stipules seen from within; 4a) leaves, dorsal and ventral views; 5a) bract, seen from within; 6a) calyx + bract.

PL. CX

1-8 VAR. ERIOPHYLLA
1A-6A VAR. FRANKENIOIDES
DALEA ERIOPHYLLA
DALEA SAFFORDII


PL. CXI
DALEA WIGGINSII
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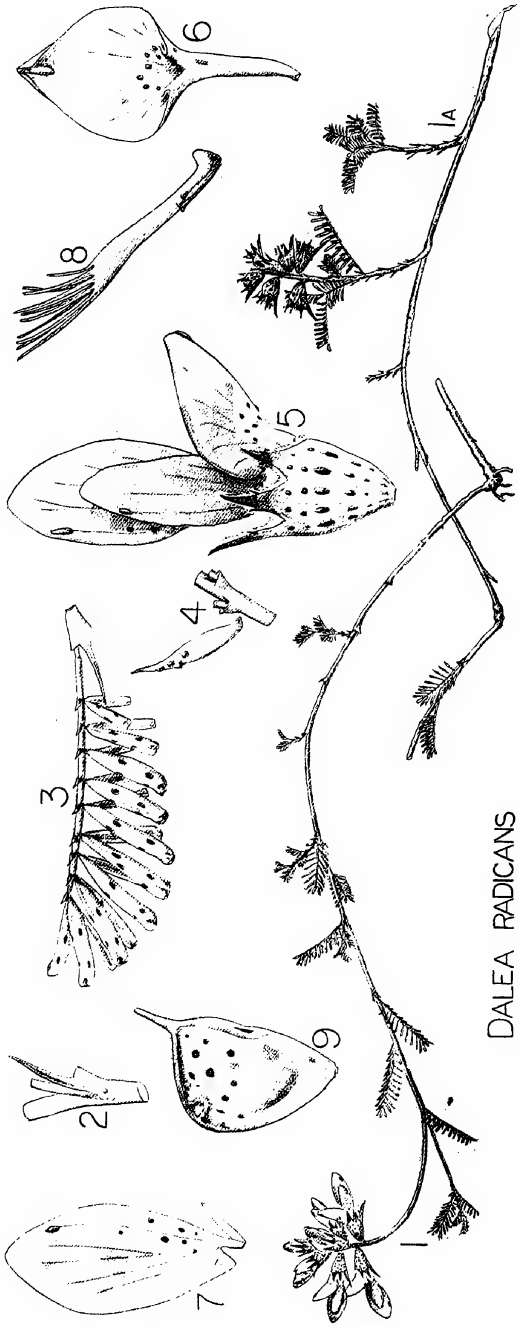
DALEA RADICANS
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1A
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PLATE CXI

Dalea wigginsii Barneby and **D. radicans** Wats. are habitally alike, very slender shrubs with diffusely arching and procumbent long-shoots from which develop, during the dry season, erect short-shoots terminating in a short loose spike of bicolored flowers. They are probably not closely related, and their ranges lie far apart in northern Mexico, that of *D. wigginsii* in the pine-oak belt on the east slope of the Sierra Madre Occidental in central Durango, that of *D. radicans*, which is strongly calciphile, in the pinyon forest of southern Coahuila and adjoining Nuevo León. The foliage of *D. wigginsii* is gray-pilosulous, the bracts and calyx are pubescent externally, and the inner petals are purple contrasting with a banner that opens pale yellow. The foliage of *D. radicans* is glabrous, like the back of the bracts and the lustrous livid-castaneous calyx-tube, and the inner petals are violet-purple contrasting with a banner that opens white. Note the incipient pedicels of *D. radicans*, and the basal lobes of the banner fused into the blade to form inversely conic pits; and compare with the sympatric *D. melantha* (Plate CXVI), a tall erect shrub with yellow flowers. Stems × 1; the rest × 5.

D. wigginsii: 1) branch, a long-shoot, in flower in October; 2) main cauline leaf; 3) bracts, at left profile view of outermost, at right ventral view of inner one; 4) flower; 5) calyx, laid open; 6) banner, ventral view; 7) wing; 8) keel; 9) androecium.

D. radicans: 1) long-shoot in flower, the early phase; 1a) same, with erect short-shoots, the late phase; 2) stipules; 3) main cauline leaf; 4) pedicels + bract; 5) flower; 6) banner, ventral view; 7) keel; 8) androecium; 9) pod.

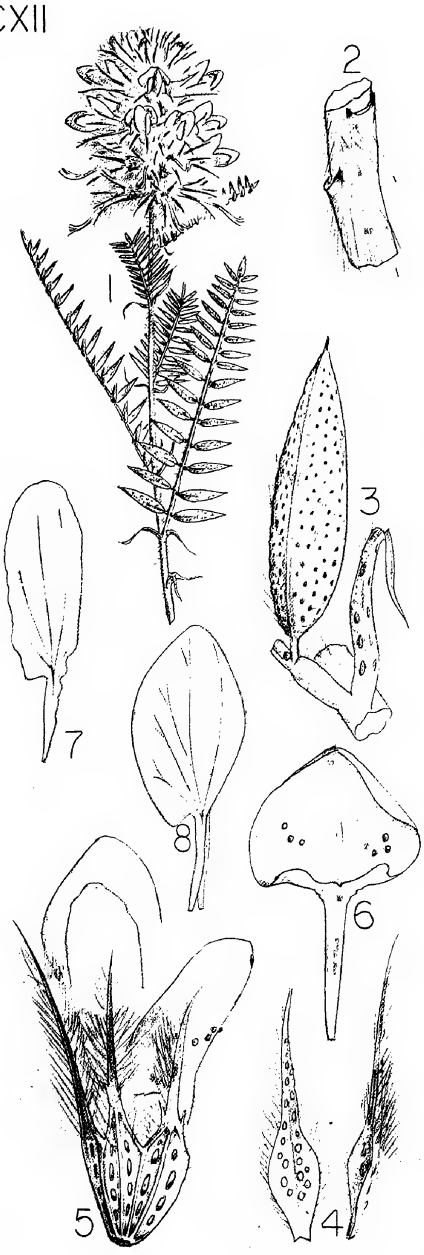
PLATE CXII

Dalea pinetorum Gentry, a low perennial herb, to be found in flower during September to November in the pine-oak forests of Sierra Madre Occidental in Chihuahua, near and w. of the Divide. A rare species, it is known in the form of two highly localized populations, var. **pinetorum** on Río Mayo just e. of the Sonora line in lat. 28° N., and var. **anilantha** Barneby on Sierra Chinatú at the sources of Río Verde near 26° N., within 20 km of Durango. The plants are finely and loosely pilose throughout, the foliage is green, and the few monocephalous stems (2–4 dm tall) give rise at base, late in the season, to more densely villous, small-leaved branchlets. Notable features are the long stipules and the long, persistent bracts. The var. *pinetorum* has ± 10–16 pairs of acute leaflets in the main leaves, stems retrorsely pilose at base, glabrate calyx-tube, and bicolored flowers, the gland-sprinkled banner opening pallid in contrast to the purple wings and keel. The var. *anilantha* has only 8–10 pairs of obtuse leaflets, stems spreading-pilosulous at base, calyx plumose from the base upward, and all the petals indigo-blue, the glandless banner variegated with a whitish, finally rubescent eye. — Inflorescence × 1; the rest × 5.

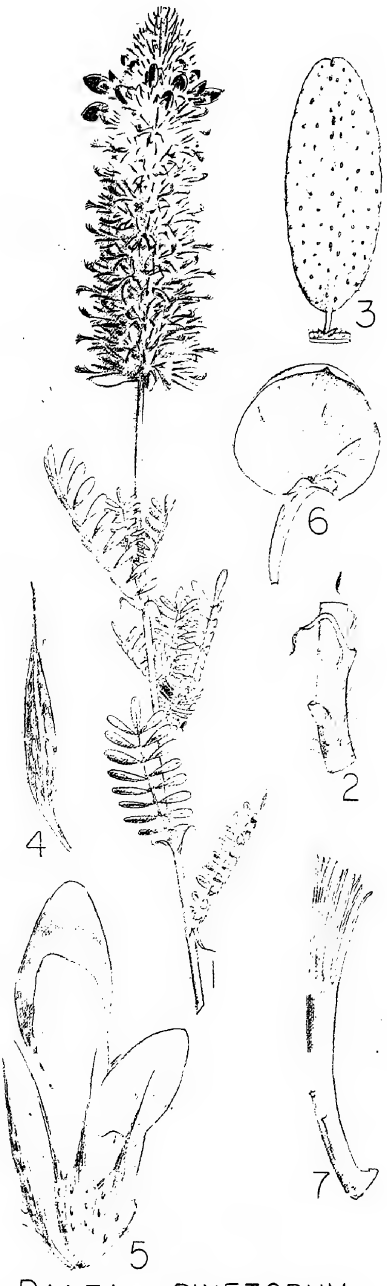
var. *pinetorum*: 1) top of stem; 2) part of base of stem; 3) stipule + lowest leaflet in dorsal view; 4) bracts, ventral and profile views; 5) flower; 6) banner, ventral view; 7) wing; 8) keel.

var. *anilantha*: 1) top of stem; 2) part of base of stem; 3) leaflet, dorsal view; 4) bract, ventral view; 5) flower + bract; 6) banner, ventral view; 7) androecium.

CXII



DALEA PINETORUM
VAR. PINETORUM

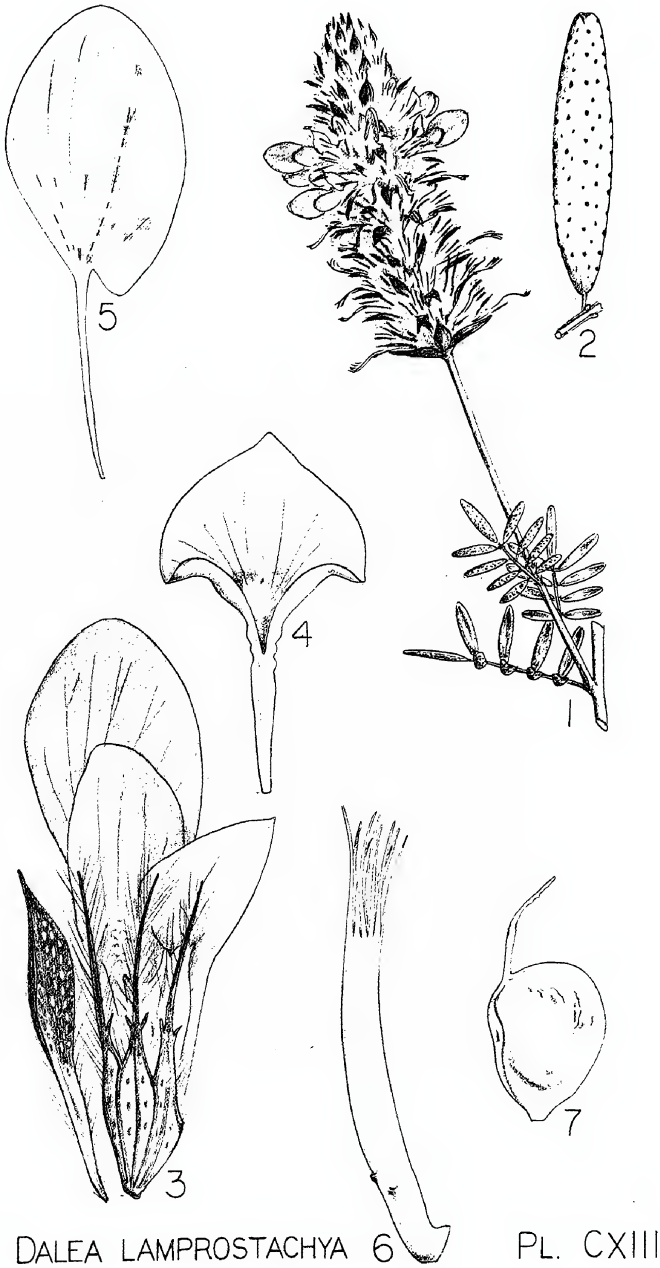


DALEA PINETORUM
VAR. ANILANTHA

PLATE CXIII

Dalea lamprostachya Barneby, a handsome shrub of local dispersal on the Pacific slope of Sierra Madre Occidental in Sinaloa and probably adjoining Nayarit and Durango, flowering in winter. The few pairs of long but narrow, glabrous leaflets of thick texture, the massive spike of large bicolored flowers, the persistent bracts, glandless petals, and glabrous ovary form a combination unique in the genus. — Branchlet $\times$ 1; the rest $\times$ 5.

1) flowering branchlet; 2) leaflet, dorsal view; 3) flower + bract; 4) banner, ventral view; 5) keel-petal; 6) androecium; 7) young pod.



DALEA LAMPROSTACHYA PL. CXIII

PLATE CXIV

Dalea botterii (Rydb.) Barneby, a handsome shrubby species reaching a stature of 1.2 m, has dark green foliage tending to blacken when dry, and bright violet or indigo-violet petals that turn brown or black as they fade. Except for the violet flowers the species closely resembles *D. lutea*; important features common to both are the persistent, livid or blackish bracts and the prominent blackish glands on the back of the leaflets and in the intervals of the glabrescent or glabrous calyx-tube. The apparently interrupted (but probably little known) range of *D. botterii* lies along the east edge of the Mexican plateau, from s. Tamaulipas to s. Puebla. Northward from the Orizaba region it is represented by var. **botterii**, which has about 7–12 pairs of strongly keeled, narrow leaflets, long calyx-teeth, and large flowers. In the mountains around Tehuacán, at the south limit of the species range, var. *botterii* is replaced by var. **atrocyanea** (Rydb.) Barneby, differing in its fewer, broader leaflets that lack a prominent keel on the back, its shorter calyx-teeth, and smaller flower. Inflorescences × 1; the rest × 5.

1–8: var. *botterii*. 1) branchlet + spike; 2) stipules; 3) leaflets; 4) flower + bract; 5) banner, ventral and profile views; 6) wing; 7) keel; 8) androecium.

9–15: var. *atrocyanea*. 9) branchlet + spike; 10) stipules; 11) leaflets; 12) flower + bract; 13) banner, ventral and profile views; 14) wing; 15) keel.

CXIV
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DALEA
1–8 VAR. BOTTERII
BOTTERII – 9–15
VAR. ATROCYANEA

PLATE CXV

Dalea lutea (Cav.) Willd., a polymorphic species dispersed over much of continental Mexico, from n. Coahuila and centr. Chihuahua s. to Guerrero, and e. through Chiapas into the highlands of Guatemala. It is the only dalea in which livid, persistent bracts are combined with flowers that open pale greenish-yellow to light golden-yellow and (nearly always) turn brown or black in fading. The dried foliage is commonly nigrescent also. The var. **lutea**, of Mexico n. of the Neovolcanic Belt, is herbaceous or bushily suffruticose, rarely over a meter tall, and relatively large-flowered; stems, leaves, and calyx-tubes vary from glabrous to densely gray-pilosulous. A rare var. **arsenei**, with similar flower but leaflets (glabrate) up to 15 pairs in the main cauline leaves, has been collected in Michoacán and Guerrero (not illustrated). The var. **gigantea**, a shrub attaining a stature of 4 m, is found within the Neovolcanic Belt in Michoacán and s.-w. México, and disjunctly in Chiapas and Guatemala. Its foliage and stems are characteristically pilosulous, the flowers are small, and the petals turn truly black when old. — Inflorescences × 1; the rest × 5.

var. *lutea*: 1) flowering branchlet; 2) flower + bract; 3, 4, & 5) leaflets (dorsal view) with the corresponding calyx, showing part of the variation in pubescence, leaflet-shape, and length of calyx-teeth; 6) banner, ventral and profile views; 7) androecium.

var. *gigantea*: 8) flowering branchlet; 9) stipules; 10) leaflet, dorsal view; 11) flower + bract; 12) banner, ventral view; 13) wing; 14) keel; 15) pod.

PL. CXV

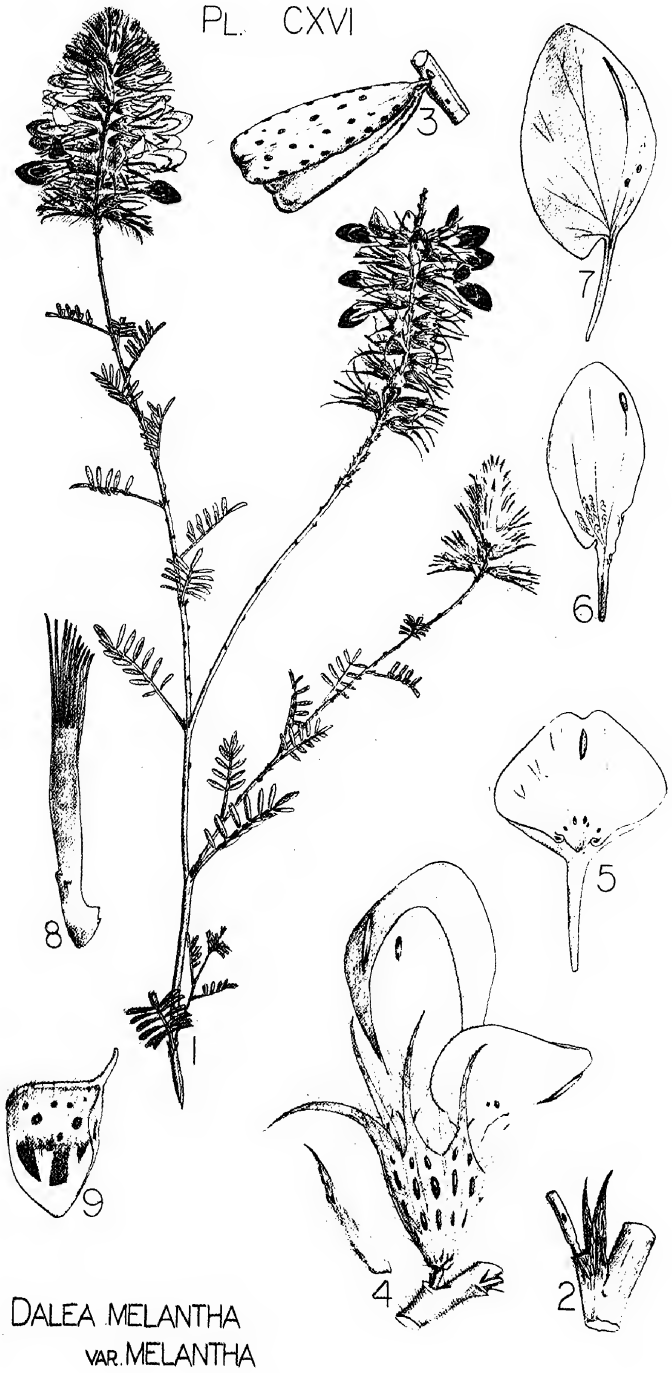
DALEA LUTEA
1—7 VAR. LUTEA

8—15
VAR. GIGANTEA

PLATE CXVI

Dalea melantha Schauer var. **melantha**, the typical and commonest form of a shrubby, yellow-flowered dalea dispersed mainly on calcareous or gypseous soils through Sierra Madre Oriental from southern Coahuila to Oaxaca, further illustrated in Plate XCVII. Notable features of the whole species are the pedicelled flowers, deciduous interfloral bracts, long, silvery-plumose calyx-teeth, and the pale greenish-yellow hue of all petals which passes rapidly, after fertilization of the flower, into brown or black. The var. *melantha* is a slender shrub up to about 1–1.5 m tall with few or but one slender trunk branching upward into a crown of pliant castaneous branchlets. Within its species var. *melantha* may be recognized by the 3–6 pairs of usually small and at broadest narrowly obovate leaflets, always glabrous, Its range extends from central Nuevo León south to Oaxaca. — Branch × 1; the rest × 5.

1) flowering branch; 2) stipules; 3) leaflets; 4) flower + bract; 5) banner, ventral view; 6) wing; 7) keel-petal; 8) androecium; 9) pod.


PL. CXVI
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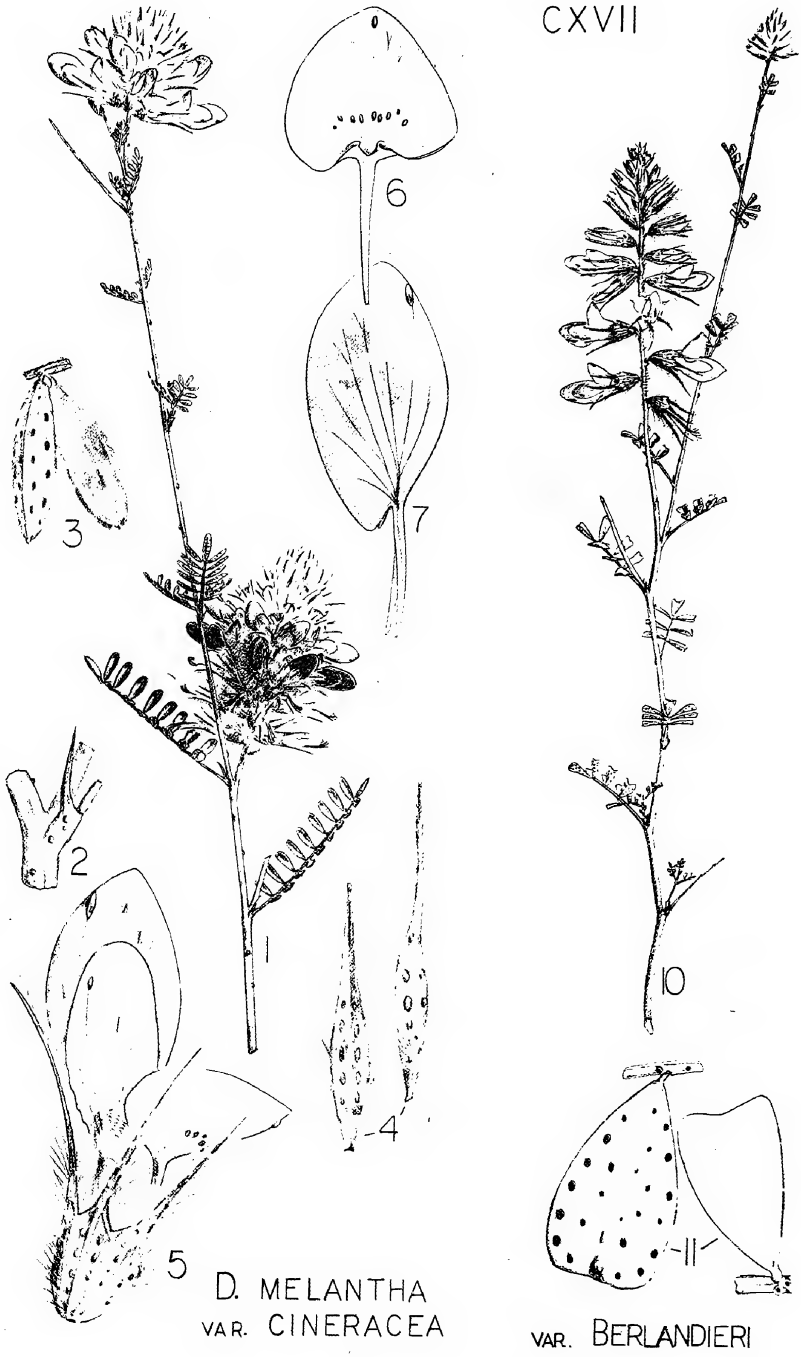
DALEA MELANTHA
VAR. MELANTHA

PLATE CXVII

Dalea melantha Schauer var. **cineracea** Barneby and var. **berlandieri** (Gray) Barneby, relatively rare and local varieties of the widely dispersed Mexican *D. melantha*, figured in typical form on Pl. CXVI. The var. *berlandieri*, sympatric with var. *melantha* northward from San Luis Potosí but ranging beyond it into Coahuila, is ideally distinguished by the few (2 or 3) pairs of large and broad leaflets combined with a loose raceme of flowers, but is not always strongly marked. The var. *cineracea*, known from one station in northern Oaxaca, where it occurs on andesitic bedrock in the oak-belt, differs from var. *melantha* in its many (7–10) pairs of gray-silky leaflets. See also caption to Pl. CXVI. — Stems × 1; the rest × 5.

var. *cineracea*: 1) flowering branchlet; 2) stipules; 3) leaflets; 4) interfloral bract, ventral and dorsal views; 5) flower; 6) banner, ventral view; 7) keel.

var. *berlandieri*: 10) flowering branchlet; 11) leaflets.


CXVII
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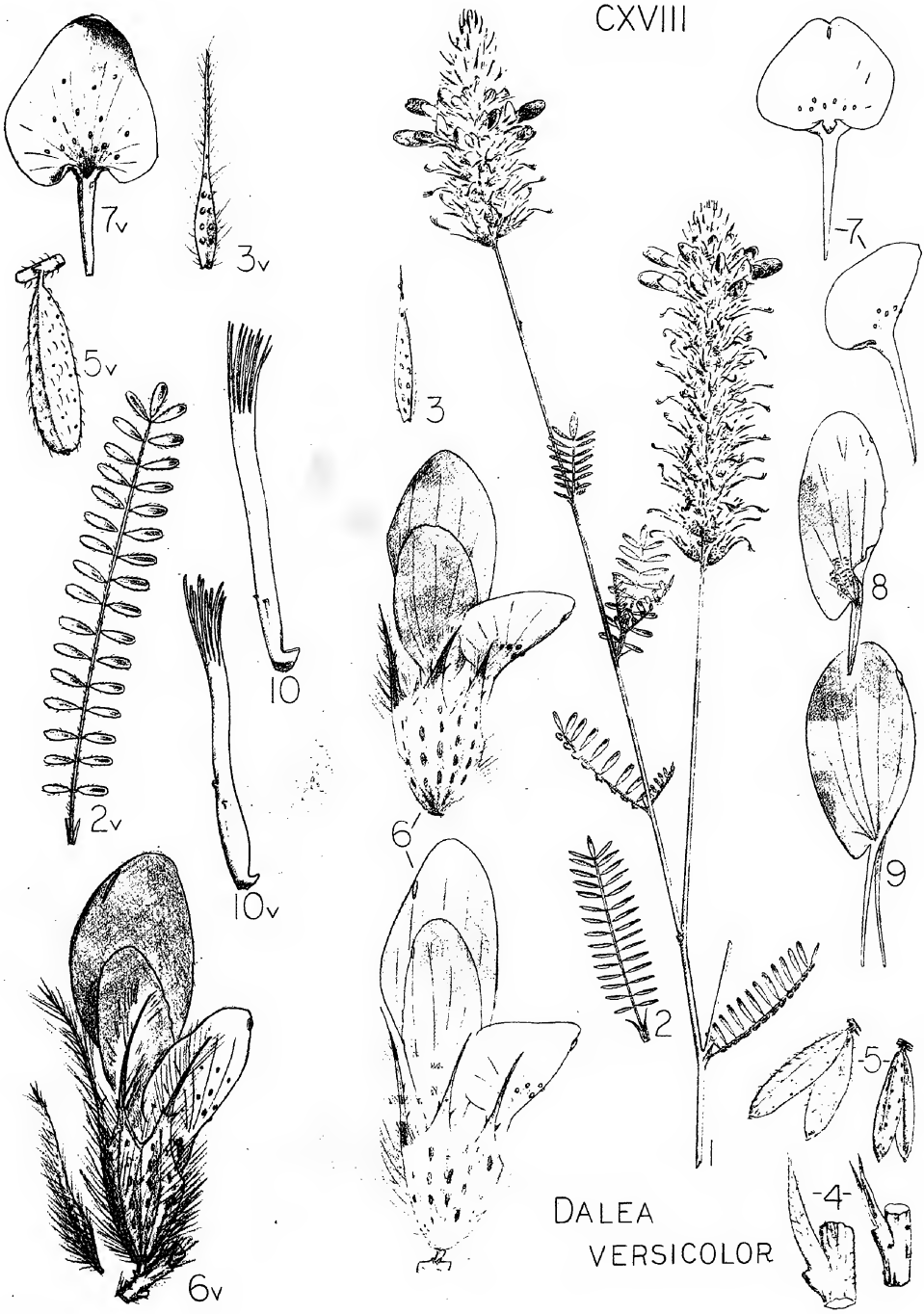
D. MELANTHA
VAR. CINERACEA
VAR. BERLANDIERI

PLATE CXVIII

Dalea versicolor Zucc., one of the most widely ranging and polymorphic of the shrubby or suffruticose daleas, consists of numerous geographic races dispersed from southern Arizona south through western, central and southern Mexico into Guatemala; features common to all forms of it are the plumose, long-toothed calyx, often shortly pedicelled, and bicolored flowers, the banner opening pale yellow or whitish with yellow eye, the wings and keel some shade of pink or purple. The var. **versicolor** represents the species in the highlands of Oaxaca, Chiapas, and Guatemala. The plants may be either diffuse or erect and virgate, and the foliage varies from gray-pilosulous to green and glabrous, but the inner petals are almost always dull reddish-lavender or claret purple. Inflorescence and main cauline leaves × 1; the rest × 5; figures followed by v taken from authentic material in the Martius herbarium, cultivated under glass in Munich.

1) inflorescence; 2, 2v) main cauline leaves; 3, 3v) bracts, ventral view; 4) stipules of glabrous and pubescent phases; 5) leaflets of same; 5v) leaflet, dorsal view; 6, 6v) flowers; 7, 7v) banner; 8) wing; 9) keel; 10, 10v) androecia.


CXVIII
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3v
5v
2v
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10v
6v
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DALEA
VERSICOLOR

PLATE CXIX

Dalea versicolor Zucc. (pars): lower right, tips of leaf-rachis × 5, in ssp. **versicolor** subterete, in ssp. **argyrostachya** grooved its whole length; 3 varieties of ssp. *versicolor* from s.-w. United States and Mexico. These are all small shrubs or suffrutescent herbs with foliage either glabrous or pilosulous, silky-villous calyces often minutely pedicelled, and rose-purple epistemonous petals expanded in autumn, winter and spring. The var. **sessilis** (Gray) Barneby is shown in its spring-flowering phase, when all but the uppermost primary cauline leaves have fallen and many axillary short-shoots are coming into flower; this variety ranges from s.-e. New Mexico and adjoining Arizona to n.-w. Mexico, and is replaced in the latitudes of s. Sonora and Sinaloa, along the Pacific slope of Sierra Madre, by the closely related var. **calcarata** (Gentry) Barneby, ideally different in its more numerous leaflets. The var. **decipiens** Barneby, very like var. *sessilis* but the leaflets with numerous small (not about 6–12 large and black) dots on the back, represents ssp. *versicolor* in Jalisco and Michoacán and possibly along the Sierra Madre del Sur; it is geographically intermediate to var. *versicolor* in Oaxaca and southward. — Flowering branch and detached primary leaves × 1; the rest × 5.

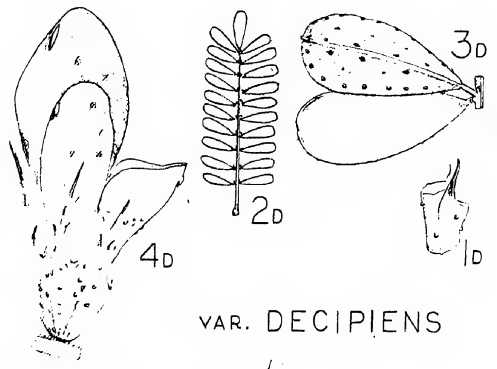
var. *sessilis*: 1) flowering branch; 2) stipules; 3) leaflets; 4) bract + flower; 5) banner, ventral view.

var. *decipiens*: 1d) stipules; 2d) primary leaf; 3d) leaflets; 4d) flower.

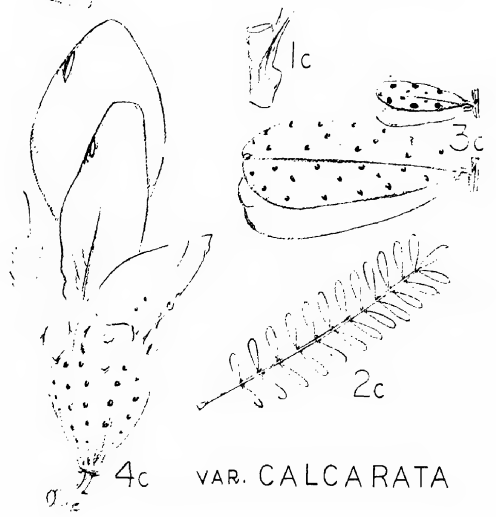
var. *calcarata*: 1c) stipules; 2c) primary leaf; 3c) leaflets; 4c) flower.

PL. CXIX

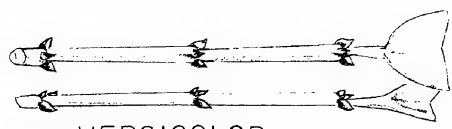
DALEA VERSICOLOR
SSP. VERSICOLOR
VAR. SESSILIS



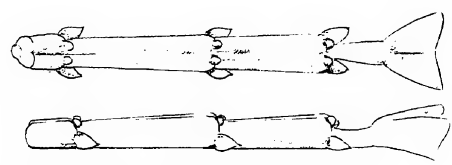
VAR. DECIPIENS



VAR. CALCARATA



SSP. VERSICOLOR



SSP. ARGYROSTACHYA

PLATE CXX

Dalea versicolor Zuccarini var. **argyrostachya** (Hooker & Arnott) Barneby and var. **involuta** (Rydberg) Barneby, geographical races of *D. versicolor* (Pl. CXVIII), both Mexican, the first confined to the Pacific slope in Sinaloa and Nayarit. var. *involuta* to the Transverse Volcanic Belt e.-ward from Jalisco. Both are referred to a collective subsp. *argyrostachya*, of which the characteristic leaf-rachis is shown on Pl. CXIX. Within the subspecies the differential characters of var. *argyrostachya* are the stiff, openly grooved rachis and pale lilac or whitish epistemonous petals. Note the seasonal aspects, fig. 1 showing the massive inflorescence produced at end of the rainy summer, terminal to stems still clad in primary cauline leaves, fig. 1A the many small, capitate spikes produced in dry winter or spring months, issuing from axils of now fallen primary leaves. Differential characters of var. *involuta* are relatively few (up to 8) pairs of nearly always glabrous leaflets set on a subterete rachis, and rose-purple epistemonous petals. — Flowering stems × 1; the rest × 5.

var. *argyrostachya*: 1) inflorescence in autumn; 1A) do., in dry season; 2) leaflets; 3) flower.

var. *involuta*: 1) top of flowering stem; 2) stipules; 3) leaflets; 4) flower + bract; 5) banner, ventral and profile views; 6) wing; 7) keel; 8) androecium.

PL. CXX

DALEA VERSICOLOR
SSP. ARGYROSTACHYA
VAR. ARGYROSTACHYA

VAR. INVOLUTA

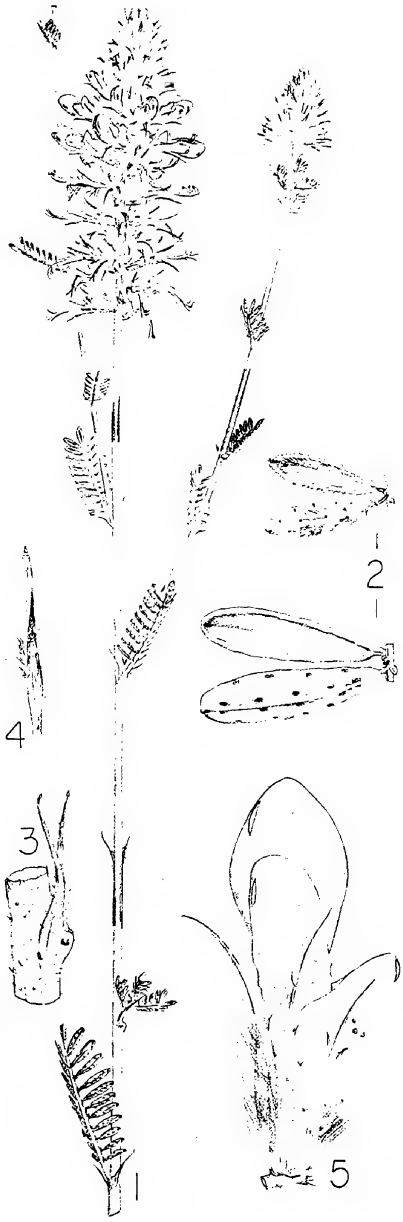
PLATE CXXI

Dalea tentaculoides Gentry and **D. versicolor** Zucc. ssp. **argyrostachya** (H. & A.) var. **glabrescens** (Rydb.) Barneby, suffrutescent herbs or small shrubs with prominently dotted foliage and bicolored flowers opening in the dry season, fall through winter, the banner whitish or pale yellow, the epistemonous petals rose-purple to pale lilac. The foliage of *D. tentaculoides*, a species of local occurrence in pine-oak forest of s.-e. Arizona, is either glabrous or minutely puberulent; the unique calyx lacks glands in the panels of the tube but bears on the teeth prominently developed gland-spurs drawn out into subulate or prickle-shaped processes. The var. *glabrescens*, which represents its polymorphic species in the grasslands and lower oak-belt of the Mexican Plateau and e. piedmont of Sierra Madre Occidental between centr. Chihuahua, Guanajuato, and San Luis Potosí, is commonly gray-pilosulous, more rarely almost glabrous up to the softly silky flower-spikes. The plants flower in autumn as tall virgate herbs, the densely leafy stems terminating in a few-branched panicle, but when circumstances favor growth into spring the cauline leaves are replaced by short-shoots bearing many subsessile shorter spikes, the vernal aspect simulating that shown for var. *sessilis* in Pl. CXIX. — Flowering stems and a detached cauline leaf × 1; the rest × 5.

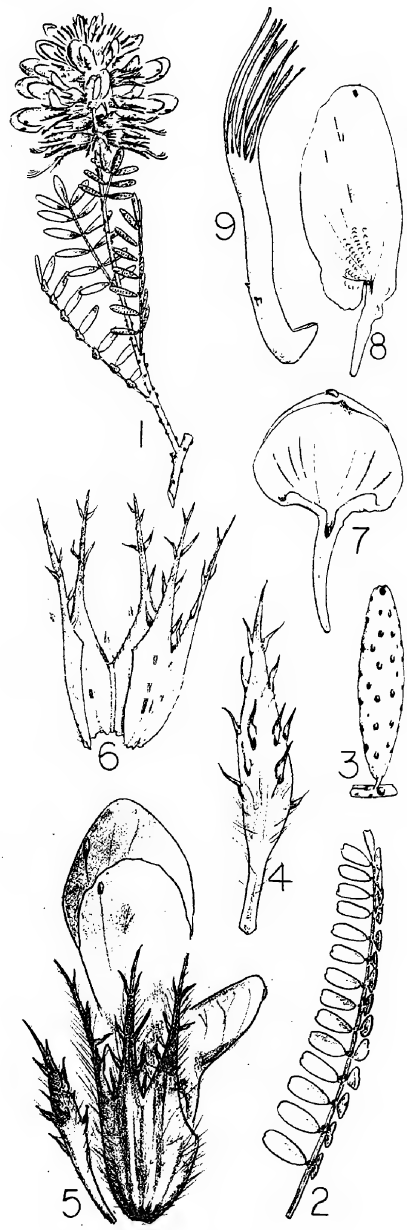
A. tentaculoides: 1) lateral branchlet, flowering in winter; 2) primary cauline leaf; 3) leaflet, dorsal view; 4) bract, dorsal view; 5) flower + bract; 6) calyx, laid open; 7) banner, ventral view; 8) wing; 9) androecium.

A. versicolor var. *glabrescens*: 1) terminal branches flowering in autumn; 2) leaflets; pubescent and glabrate; 3) stipules; 4) bract, ventral view; 5) flower.

PL. CXXI



D. VERSICOLOR
SSP. ARGYROSTACHYA
VAR. GLABRESCENS



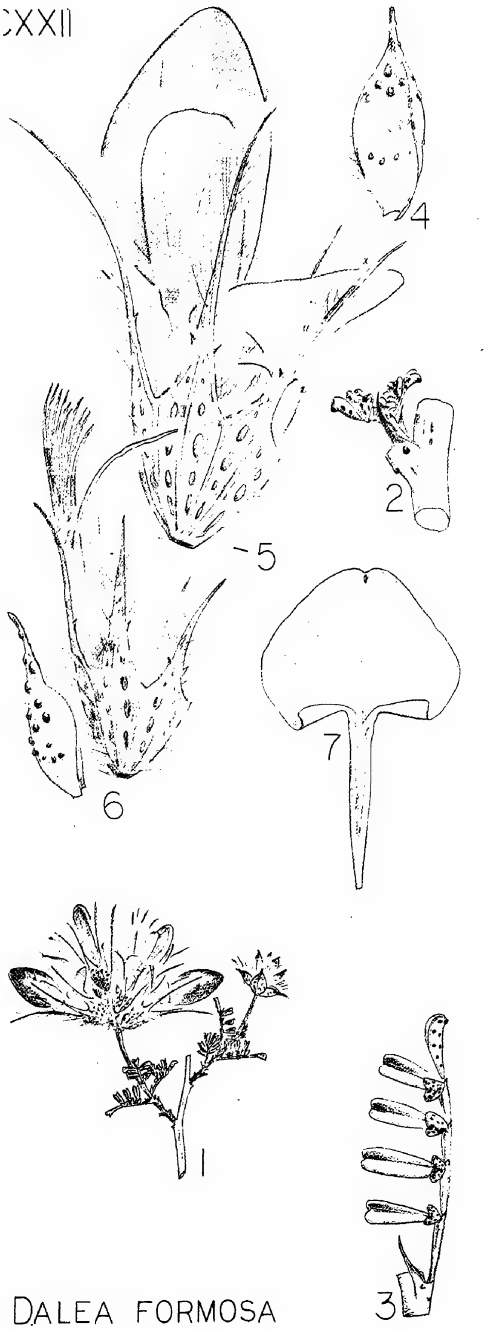
DALEA TENTACULOIDES

PLATE CXXII

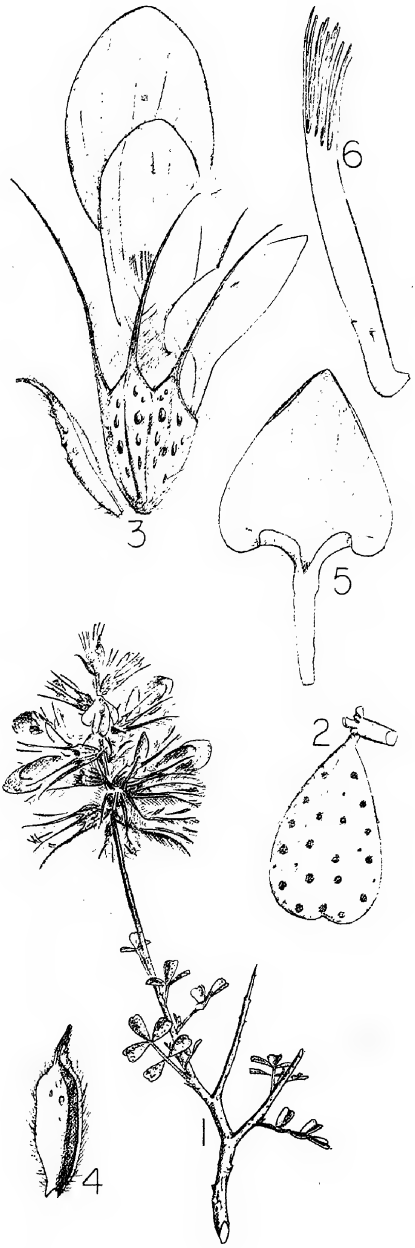
Dalea formosa Torr. and **D. purpusi** Bdg. are small, densely branching shrubs of pronounced xerophytic character, with stiff, crooked and eventually gnarled branches, lustrously plumose, long-toothed calyces, and large (in proportion to the neat, drought-deciduous foliage very large) flowers that open bicolored, the banner whitish or cream-colored but early rubescent, the inner petals pink- or lavender-purple. The range of *D. formosa*, which is glabrous except for the calyx and ciliolate margins of the bracts, extends from central Texas, the Oklahoma Panhandle and south-central Colorado w. and s. through the valleys of the Pecos and Rio Grande and the foothills all around the sources of the Gila to the Verde valley in central Arizona, extreme northeastern Sonora, northwestern Coahuila, and along the eastern piedmont of the Sierra Madre to Ciudad Chihuahua. Scattered flowers can be found on *D. formosa* during much of the summer and fall, but the season of abundant bloom is spring, from April through June according to altitude. The rare *D. purpusi*, known only from the east side of the Baja California peninsula between 26° and 28° N latitude, differs in its fewer, obovate leaflets thinly pubescent like the branchlets, bracts pilose on the back, and longer spikes of some 10–20 (not 2–10) flowers. Unlike those of *D. formosa*, the flowering branchlets of *D. purpusi* become hardened, the second year, into stout spines, a feature unique in *Dalea*, although found in several species of *Psorothamnus*. The flowering of *D. purpusi* is irregular and seldom observed; it occurs two months or more subsequent to heavy rains, mostly between December and April. —Flowering branchlets × 1; the rest × 5.

Dalea formosa: 1) branchlet; 2) leaf-spur + stipules and inhibited axillary branchlet; 3) main cauline leaf; 4) bract, ventral view; 5) flower (long-toothed calyx); 6) another flower (short-toothed calyx) + bract (petals removed); 7) banner, ventral view.

Dalea purpusi: 1) branchlets; 2) leaflet, dorsal view; 3) flower + bract; 4) bract, ventral view; 5) banner, ventral view; 6) androecium.



DALEA FORMOSA



DALEA PURPUSI

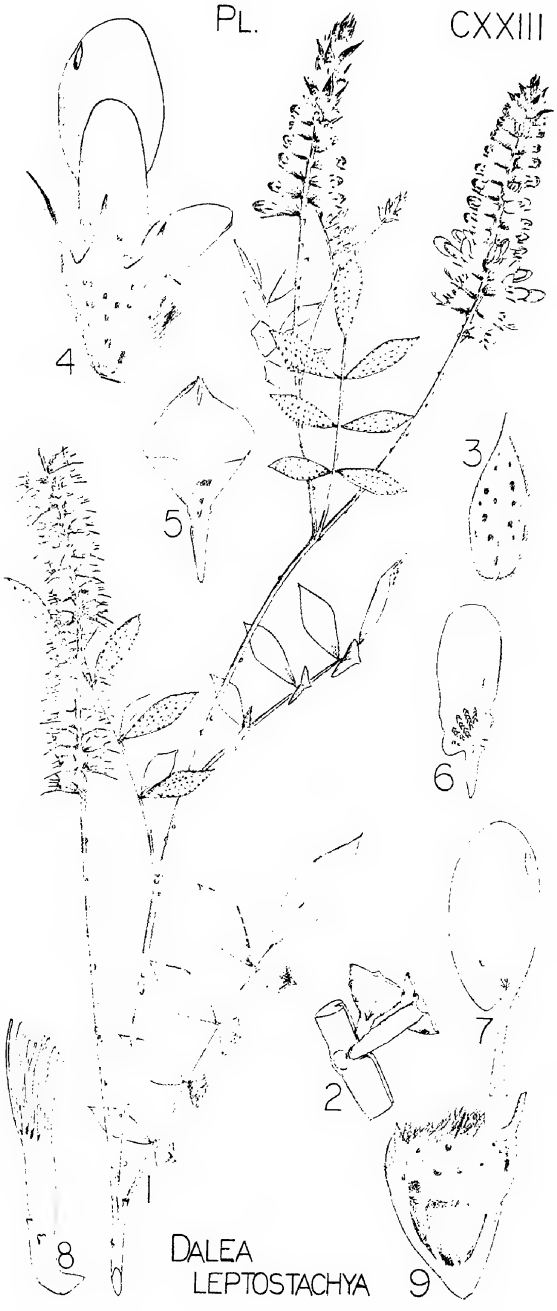
PLATE CXXIII

Dalea leptostachya DeCandolle and **D. sericocalyx** (Rydberg) Riley, the first certainly the second probably shrubby, are both Mexican, and each is taxonomically isolated in sect. *Parosela*, forming a monotypic series. Adult plants of *D. leptostachya* may reach treelet stature of 3 m, with a slender trunk and thin crown of pliantly bending branchlets. The foliage, always ample but of thick-texture, varies from glabrous to thinly pubescent; the petals are concolorous, greenish-yellow fading brown or livid. The species is locally plentiful around the eastern margins and floor of the Balsas Depression in southern Mexico, often in thorn-forest, flowering in fall and winter. The poorly known *D. sericocalyx* has been collected once only in Sierra Madre Occidental, probably on the Pacific slope east of Mazatlán. Notable features are the ample, plane leaflets of submembranous texture, a loose spike of extremely long-toothed calyces, and curious linear-oblong glands on the ovary. Color of petals is unknown.—Branchlet of *D. leptostachya* and detached leaf of *D. sericocalyx* × 1; the rest × 5.

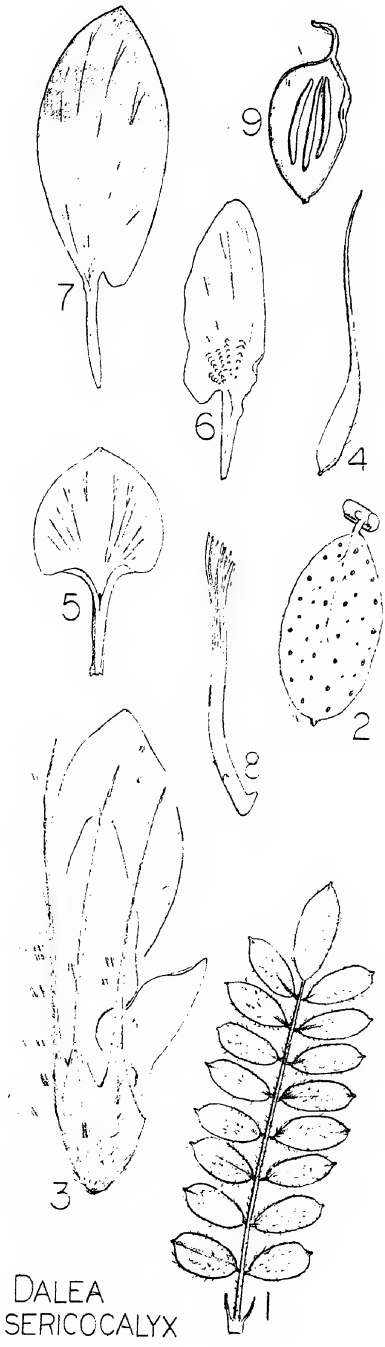
D. leptostachya: 1) flowering branchlet; 2) petiolules; 3) interfloral bract, dorsal view; 4) flower; 5) banner, ventral view; 6) wing; 7) keel; 8) androecium; 9) pod.

D. sericocalyx: 1) cauline leaf; 2) leaflets, dorsal view; 3) flower; 4) interfloral bract; 5) banner, ventral view; 6) wing; 7) keel-petal; 8) androecium; 9) ovary after fertilization.

PL. CXXIII



DALEA LEPTOSTACHYA



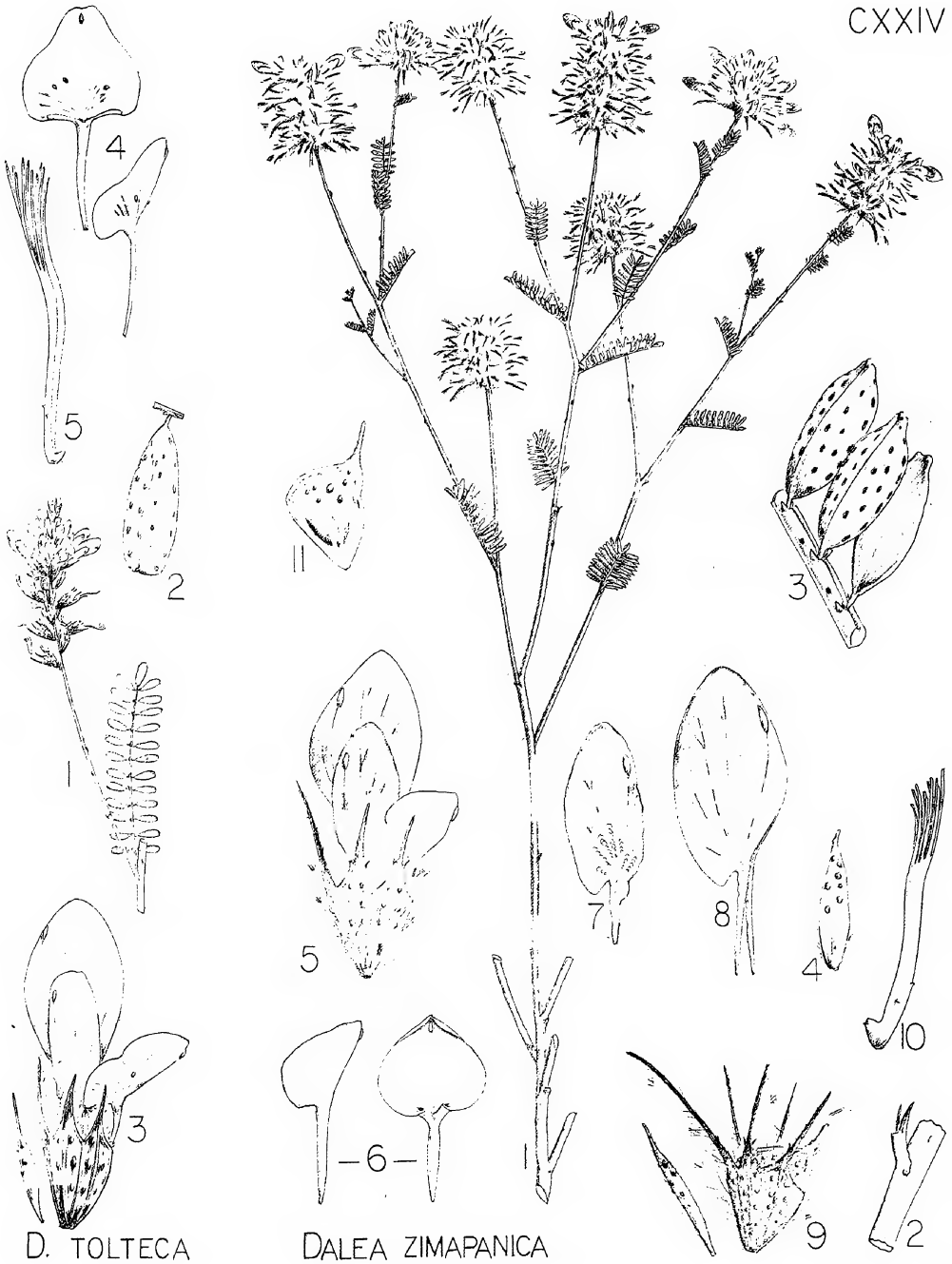
DALEA SERICOCALYX

PLATE CXXIV

Dalea zimapanica Schauer and **D. tolteca** Barneby, alike in having gland-tipped petals opening bright yellow or greenish-yellow, often edged with red, and fading to drab shades of brown or brownish-purple. The precociously flowering *D. zimapanica* early becomes a shrub, mature plants usually forming rounded bushes about a meter high, but known to reach subarborescent stature of 2.5 m, covered in the sere months of fall and winter with countless silvery-barbate heads of flower. Over nearly its whole range the foliage is glabrous, the small leaflets fleshy and conspicuously dotted, but a rare form with pilosulous leaves and stems is known. Despite its name, *D. zimapanica* is not now known to grow near Zimapán, its range lying further south. It is a common and locally abundant winter flower on parched hillsides in the Valley of Mexico, extending thence s. to the s. foothills of Nevado de Toluca, e. across the plateau to the foothills of Orizaba (just within Veracruz), s. through Puebla to the Tehuacán desert and the headwaters of Río Papaloapan, and on through dry interior valleys to centr. and s.-centr. Oaxaca. The poorly known *D. tolteca* is sympatric in Puebla with *D. zimpanica* and is possibly a hybrid derivative of the latter and some other dalea. Its loose spike of externally glabrous or nearly glabrous calyces appear distinct. — Inflorescences × 1; the rest × 5.

D. zimapanica: 1) part of panicle; 2) stipules; 3) leaflets; 4) outer bract, dorsal view; 5) flower at anthesis; 6) banner, profile and ventral views; 7) wing; 8) keel; 9) fruiting calyx + outer bract; 10) androecium; 11) pod.

D. tolteca: 1) spike + main cauline leaf; 2) leaflet, dorsal view; 3) flower + bract; 4) banner, ventral and profile views; 5) androecium.


CXXIV
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D. TOLTECA
DALEA ZIMAPANICA

PLATE CXXV

Dalea carthagenensis (Jacqu.) Macbr. (pars): the races found in South America n. of the equator, in Central America n. to Chiapas, in the Antilles, and in s. Florida. Slender, often weedy shrubs of low elevations, flowering in fall and winter, with small greenish-creamy flowers early fading dull purple or brownish, all are more or less seasonally dimorphic, the relatively ample primary foliage and pedunculate spikes of the young, vigorous growth giving way, in the dry season, to short-shoots clothed in simpler, shorter leaves and smaller, subsessile spikes. The vars. **carthagenensis**, **floridana** (Rydb.) Barneby, and **portoricana** Barneby may have stems and leaves either glabrous or variably pilosulous; the first, with relatively few (± 5–8) pairs of leaflets and relatively large-keeled flower, is common on the Caribbean slope in n. Colombia and Venezuela, extending thence feebly inland and n. disjunctly to Hispaniola and Virgin Islands; var. *floridana*, with the same flower but up to 8–11 pairs of leaflets, and var. *portoricana*, with leaflets of var. *carthagenensis* but diminutive keel-petals, are endemic to peninsular Florida and Porto Rico respectively. The var. **barbata** (Oerst.) Barneby, like var. *carthagenensis* in leaf and flower, is always pilosulous throughout, often densely so, and the small calyx-glands are masked by a dense coat of fine spiral hairs. The range of var. *barbata* extends through Central America from Chiapas into Panama and interruptedly to the n. Colombian Andes, where it fades into var. *carthagenensis*. Between s. Guatemala and Nicaragua it is sympatric with the related and similar *D. scandens* var. *vulneraria* (Plate CXXIX), distinguished by a calyx-tube glabrous and gross-glandular surmounted by pilosulous, apically hooked teeth.— Branch and detached (primary cauline) leaves × 1; leaflets × 3; the rest × 5.

var. *carthagenensis*: 1) flowering branch; 2) leaflets, pilosulous and glabrous; 3) bract, ventral view; 4) flower; 5) banner, profile and ventral views; 6) wing; 7) keel; 8) androecium; 9) pod.

var. *barbata*: 10) primary leaf + flower.

var. *portoricana*: 11) do.

var. *floridana*: 12) do.

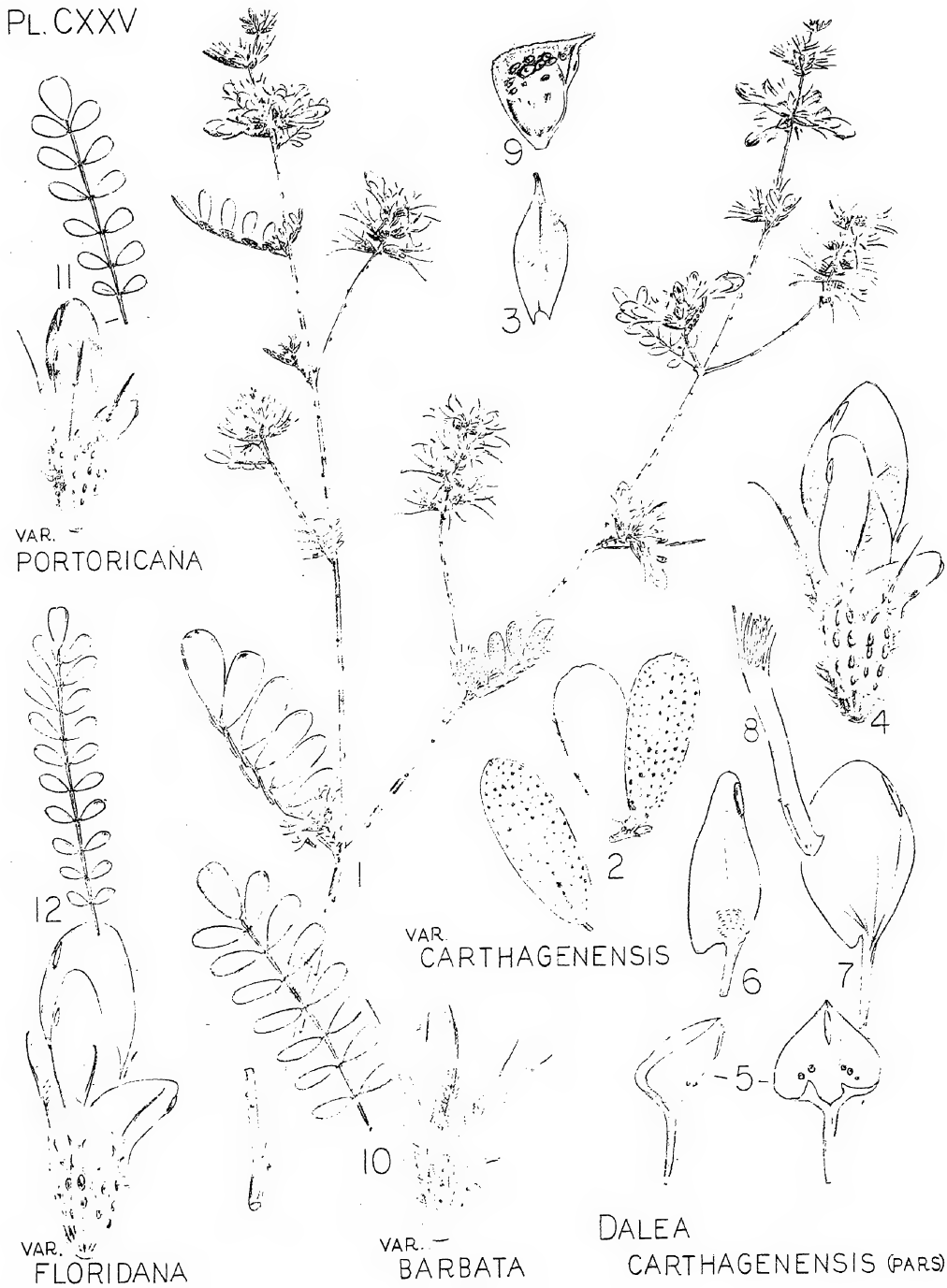

PL. CXXV
11
VAR.
PORTORICANA
9
3
1
2
VAR.
CARTHAGENENSIS
8
4
6
7
5
12
10
VAR.
FLORIDANA
VAR.
BARBATA
DALEA
CARTHAGENENSIS (PARS)

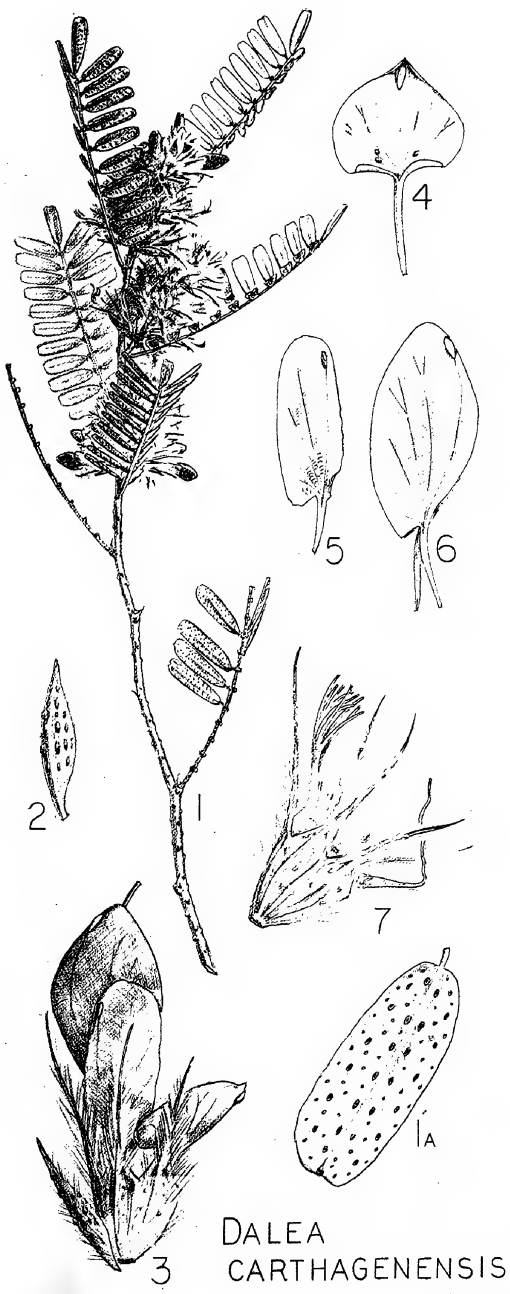
PLATE CXXVI

Dalea carthagenensis (Jacqu.) Macbr. (pars): var. **capitulata** (Rydb.) Barneby and var. **isthmicola** Barneby. Both forms are endemic to s. Mexico, the former locally abundant in arid valleys at ± 800–1550 m from s. Michoacán to Puebla and centr. Oaxaca, the latter known only from the continental divide on Isthmus of Tehuantepec near 225 m alt.; they are low shrubs, flowering in fall and winter, the gland-tipped petals opening greenish or yellowish but early fading dull maroon purple, the plant thus seeming to bear flowers of two colors. The var. *capitulata* has almost smooth stems, leaves thinly pubescent, spikes all very short and dense, and relatively few leaflets, the var. *isthmicola* prominently warty stems, glabrous leaves, short but looser spikes, and many pairs of leaflets. — Stems × 1; the rest × 5.

var. *isthmicola*: 1) flowering branchlet; 1a) leaflet, dorsal view; 2) bract, dorsal view; 3) flower + bract; 4) banner, ventral view; 5) wing; 6) keel; 7) fruiting calyx.

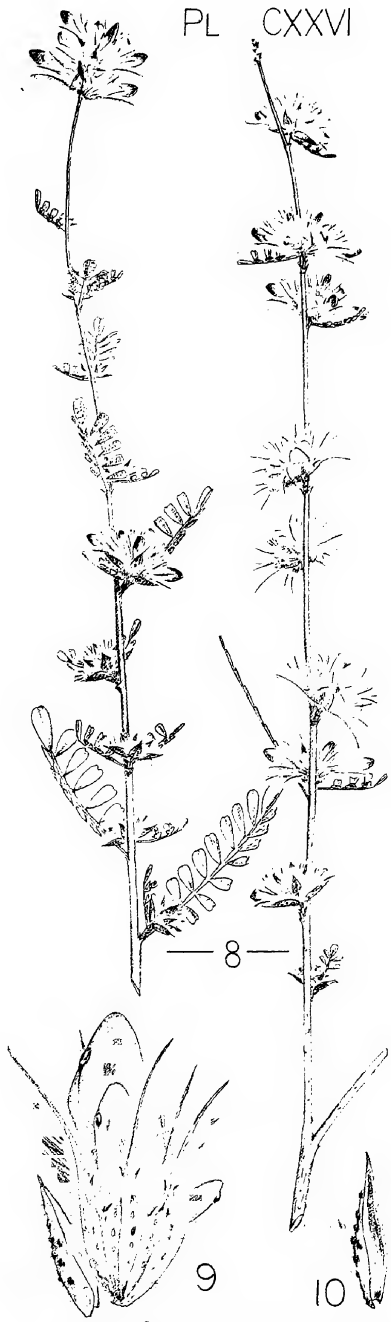
var. *capitulata*: 8) flowering branchlets, that at left early in the season, with a terminal, pedunculate spike at anthesis and short-shoots developing in axils of still green primary cauline leaves, that at right later in the year, with short-shoots at anthesis but primary cauline leaves fallen; 9) flower + bract; 10) bract, ventral view.

PL CXXVI



DALEA CARTHAGENENSIS (PARS)

1—7 VAR. ISTHMICOLA



8—10 VAR. CAPITULATA

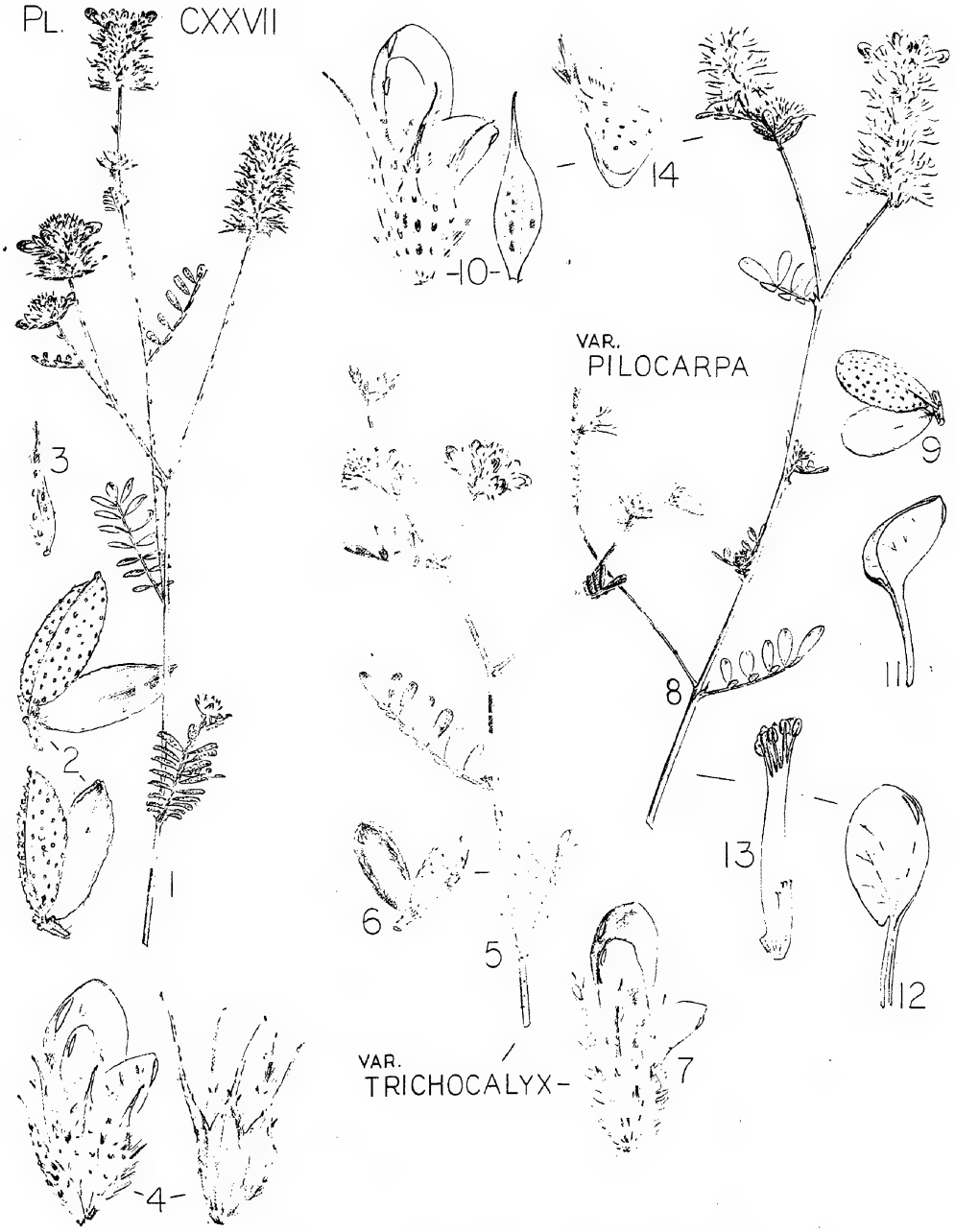
PLATE CXXVII

Dalea carthagenensis (Jacqu.) Macbr. (pars): the three endemic geographic races that represent the species on both slopes of the Andes south of the Equator: var. **brevis** (Macbr.) Barneby, of coastal desert and the Atlantic slope in s. Ecuador and n. Peru, extending s. into inter-Andean valleys of central Peru: var. **trichocalyx** (Ulbr.) Barneby, of the Pacific slope in s.-centr. Peru; and var. **pilocarpa** (Rusby) Barneby, of the east rim and slope of the Bolivian Plateau. All are small, drought-deciduous shrubs with greenish or ochroluecous flowers that quickly fade dull purple. The vars. *brevis* and *trichocalyx* have in common relatively many leaflets and dense, usually short spikes of calyces; the herbage of the former varies from glabrous to thinly pilosulous, whereas that of var. *trichocalyx* is densely and permanently gray-pilosulous. The disjunct Bolivian var. *pilocarpa* differs in its few glabrous leaflets combined with relatively loose spikes. — Flowering branchlets × 1; leaflets × 2.5; the rest × 5.

var. *brevis*: 1) branchlet; 2) leaflets, glabrous and puberulent beneath; 3) bract; 4) flower + calyx.

var. *trichocalyx*: 5) branchlets; 6) leaflets; 7) flower.

var. *pilocarpa*: 8) branchlet; 9) leaflets; 10) flower + bract, ventral view; 11) banner, profile view; 12) keel; 13) androecium; 14) pod.



VAR. BREVIS

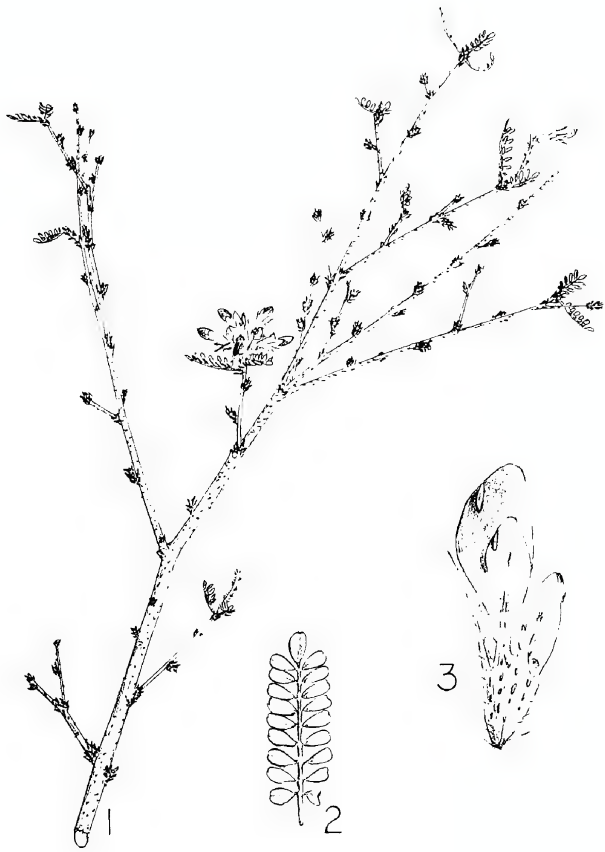
DALEA CARTHAGENENSIS (PARS)

PLATE CXXVIII

Dalea tenuicaulis Hook. f., a small xerophytic shrub endemic to the Galápagos archipelago, Ecuador, and the only species of *Dalea* known to occur there. The plants are drought-deciduous, presenting their leafy, most floriferous aspect only briefly following rains, but bearing a few depauperate, subcapitate spikes accompanied by few minute leaves even during the dry season. In form of flower and pod *C. tenuicaulis* very closely resembles the forms of *C. carthagenensis* native in subequatorial latitudes on the mainland, from which it seems most probably derived. The plants are glabrous up to the silky-villosulous flower spikes; the petals expanding from the bud are greenish or creamy, but the inner soon, and the banner in fading, turn pinkish distally or dull purple throughout. — Habit and detached leaf × 1; flower × 5.

1) Branchlet of the common drought-deciduous aspect; 2) leaf of the ample type, present only briefly following rains; 3) flower.

PL. CXXVIII



DALEA TENUICAULIS

PLATE CXXIX

Dalea scandens (Mill.) R. T. Clausen, a polymorphic complex of small shrubs native principally to the coastal plain around the Gulf of Mexico from the lower Rio Grande in Texas to Yucatán, and to the hill country at low and middle elevations in Central America, represented on the Pacific slope of Mexico by the disjunct var. **occidentalis** (Rydb.) Barneby. The plants vary from densely pubescent to glabrous, have greenish-creamy petals that early turn dull rose, brown, or blackish, and at least the dorsal calyx-tooth sharply hooked at tip. The hooked teeth distinguish *D. scandens* from the very closely related *D. carthagenensis* (Plates CXXV–CXXVII), the range of which is more southern and eastern, extending from s. Florida to Peru and Bolivia, but overlapping that of *D. scandens* only between s. Mexico and Nicaragua. The var. **paucifolia** (Gray) Barneby, prevalent from Texas to Yucatán and Cuba, has more or less villosulous foliage and 7–11 leaflets; in Guatemala it passes s. into var. **vulneraria** (OErst.) Barneby which has mostly 11–17 leaflets. Both of these have glabrous or glabrescent calyx-tube, in this and the smaller flower differing from the Pacific var. *occidentalis*. The vars. **scandens** and **gaumeri** (Standl.) Barneby, rare plants of the Gulf slope in Veracruz and Yucatán, differ collectively from the rest in their slender growth, glabrous foliage (otherwise like that of the sympatric var. *paucifolia*), and from each other in pubescence and proportions of the calyx. — Flowering branchlets × 1; the rest × 5.

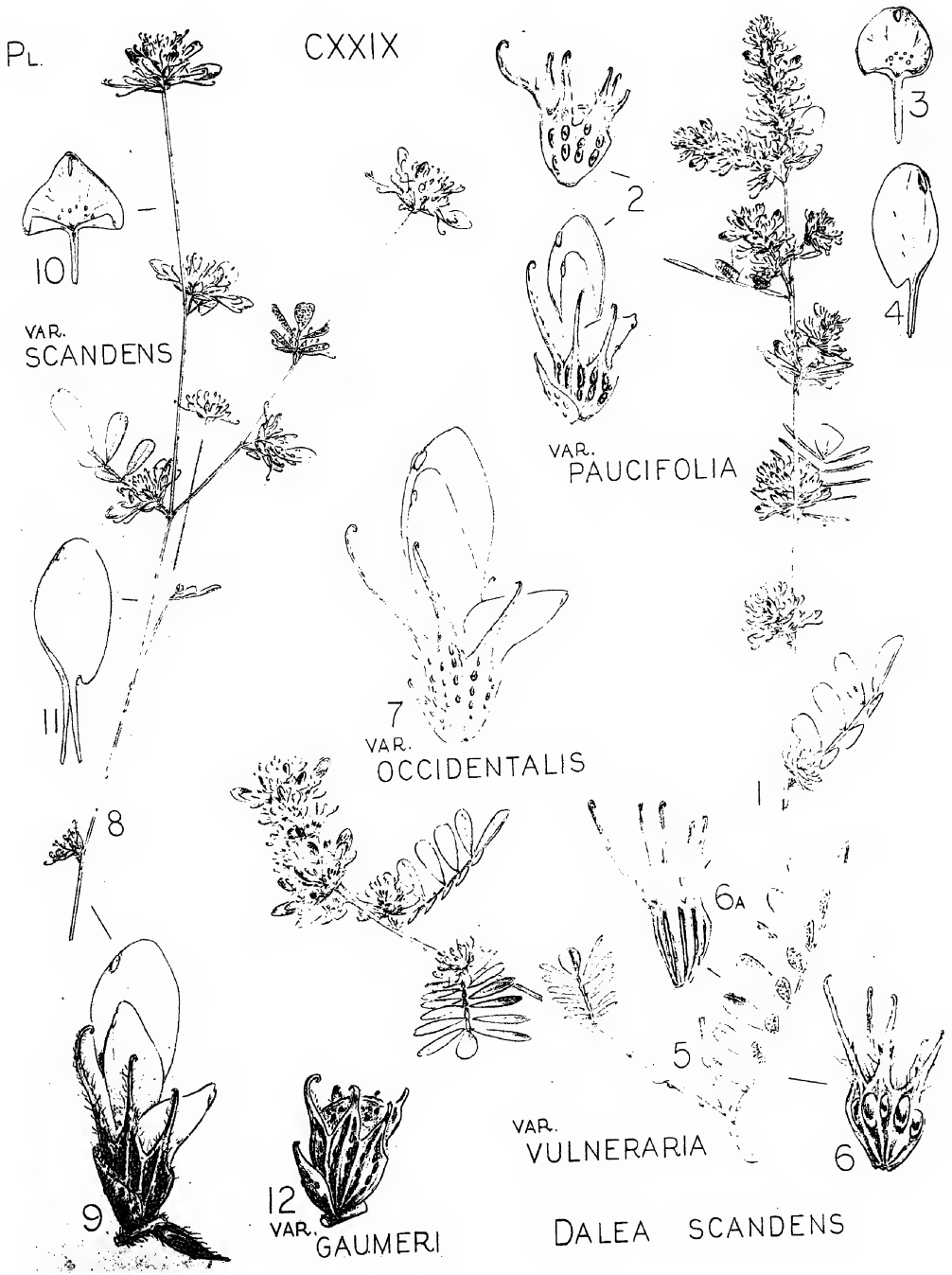
var. *paucifolia*: 1) branchlet; 2) flowers, at and after anthesis; 3) banner, ventral view; 4) keel.

var. *vulneraria*: 5) branchlet; 6, 6a) calyces.

var. *occidentalis*: 7) flower.

var. *scandens*: 8) branchlet; 9) flower; 10) banner. ventral view; 11) keel.

var. *gaumeri*: 12) fruiting calyx + pod.


PL. CXXIX
10
VAR. SCANDENS
2
VAR. PAUCIFOLIA
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VAR. OCCIDENTALIS
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8
6A
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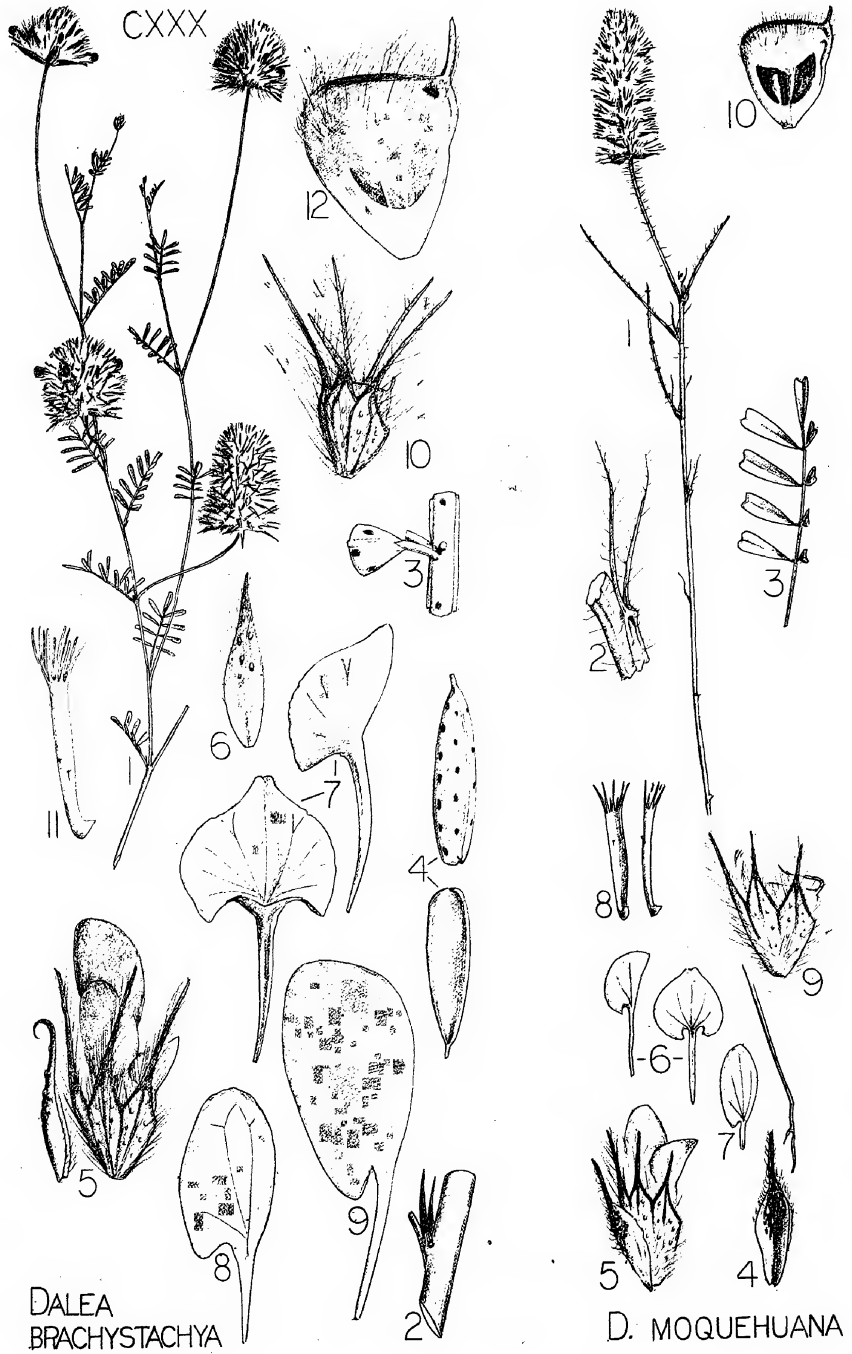
9
12
VAR. GAUMERI
VAR. VULNERARIA
6
DALEA SCANDENS

PLATE CXXX

Dalea brachystachya Gray and **D. moquehuana** Macbride, despite a family resemblance are remote both in range and relationship, the first North American and yellow-flowered, the other Peruvian and with purplish petals; both constitute monotypic series of sect. *Parosela*, from which they stand out as notable for the annual (*D. brachystachya* sometimes weakly perennant) life-span. The range of *D. brachystachya*, which is glabrous below the spikes, extends over much of the Mexican Plateau, reaching south into Puebla and north into southwestern United States. It is the only yellow-flowered annual dalea. The thinly hairy *D. moquehuana* is a rare ephemerophyte of the Pacific Andean slope in southern Peru, flowering after rains and soon perishing. It is notable for the tiny flower, the scarcely exserted petals, and in particular for the degenerate androecium of only five functional stamens. No other South American dalea resembles it. — Habit × 1; segment of leaf-rachis, petals, and pod of *D. brachystachya* × 10; the rest × 5.

D. brachystachya: 1) top of flowering stem; 2) stipules; 3) segment of leaf-rachis + petiolules; 4) leaflets, dorsal and ventral; 5) flower + bract; 6) interfloral bract; 7) banner, profile and ventral views; 8) wing; 9) keel; 10) fruiting calyx; 11) androecium; 12) pod.

D. moquehuana: 1) plant in fruit, the foliage already largely deciduous, + 3) detached leaf to same scale: 3) stipules; 4) bract, ventral view; 5) flower + bract; 6) banner, profile and ventral views; 7) keel; 8) androecia; 9) fruiting calyx; 10) pod.


CXXX
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DALEA
BRACHYSTACHYA
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D. MOQUEHUANA

PLATE CXXXI

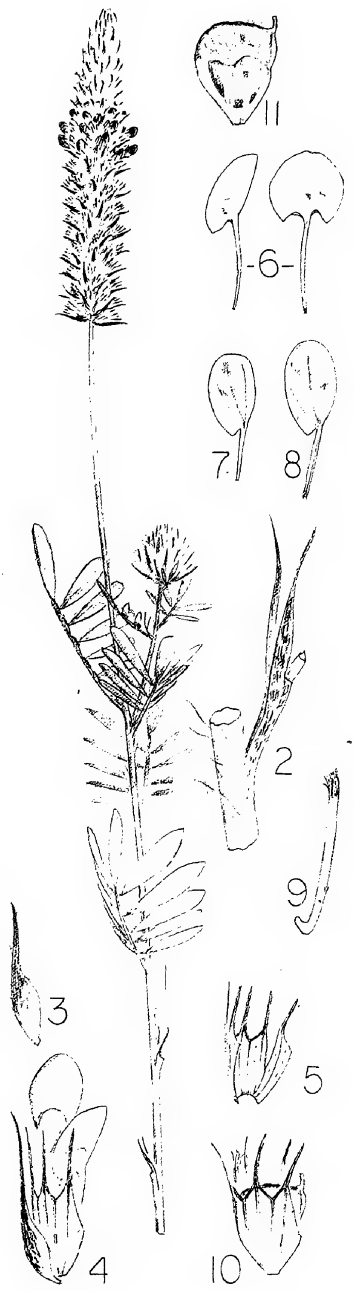
Dalea humilis G. Don and **D. reclinata** (Cav.) Willd. are obligately annual and alike in the pubescence of fine, spirally twisted hairs, well-developed stipules, relatively few pairs of membranous leaflets, and small flowers with dorsally recessed calyx-tube and a banner as long or longer than the keel. Both are variable in vigor, stature (but stems rarely over 4 dm long), and size of the calyx and petals. The spikes of the usually diffuse *D. humilis* are at least partly leaf-opposed, the leaflets are few (mostly 2 or 3 pairs), and the hairs on the back of the bracts are filiform. The petals vary from whitish through pale pink or brownish pink to purple. A common and locally abundant weed of fields and roadsides, mostly below 2000 m, throughout the Transverse Volcanic Belt of Mexico from Nayarit to Puebla and Hidalgo, it extends s.-e. into centr. Oaxaca, and n.-w., becoming rarer, along the w. edge of the Meseta Central into centr. Durango. The spikes of *D. reclinata* are terminal to the erect main stem or to incurved-ascending lateral ones, the leaflets are more numerous (4–5 pairs in at least some leaves) and commonly broader, and the hairs on the back of the bracts are minutely bulbous-based. The petals vary from pinkish to dull purplish-blue. The range of *D. reclinata* lies almost entirely within that of *D. humilis*, but is not only more restricted spatially and altitudinally but highly discontinuous. The species is common in temperate grassland and pine-forest, mostly between 2000 and 2700 m, in the Valley of Mexico, extending just into Morelos and Hidalgo, and w. through the mountains into n.-centr. Michoacán. It reappears disjunctly and uncommonly on the e. slope of Sierra Madre Occidental between centr. Durango and s. Chihuahua. — Habit × 1; the rest × 5.

D. humilis: 1) part of stem, robust phase; 2) stem, depauperate phase; 3) stipules; 4) raceme-axis; 5) flowers + bracts; 6) banners; 7) wings; 8) keels; 9) androecia; 10) fruiting calyx and pod.

D. reclinata: 1) part of stem; 2) stipules; 3) bract; 4) flower + bract; 5) calyx, laid open; 6) banner, ventral and profile views; 7) wing; 8) keel; 9) androecium; 10) fruiting calyx; 11) pod.

CXXXI

DALEA HUMILIS



DALEA RECLINATA

PLATE CXXXII

Dalea sericea Lagasca, a coarsely leafy, herbaceous or weakly suffrutescent herb of Mexico and Guatemala, with massive, silky-barbate, headlike spikes of dull blue or purplish flowers. The common form, var. **sericea** (fig. A, × 1/10), has few or solitary, erect or assurgent, commonly monocephalous, at best few-headed stems; the more local var. **humistrata** Barneby (fig. B, × 1/10) of mountainous central Oaxaca has many radiating, pliantly prostrate stems that branch both at base and distally, forming mats of silvery-greenish foliage surrounded by a ring of incurved heads. — Flowering stem × 1, leaflet × 2, pod × 10, the rest × 5.

var. *sericea*: A) habit sketch; 1) top of flowering stem; 3) stipules; 4) bract, ventral view; 5) flower + bract; 6) banner, ventral and profile views; 7) wing; 8) keel; 9) androecium; 10) pod.

var. *humistrata*: B) habit-sketch.

PL. CXXXII
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A
B
DALEA SERICEA

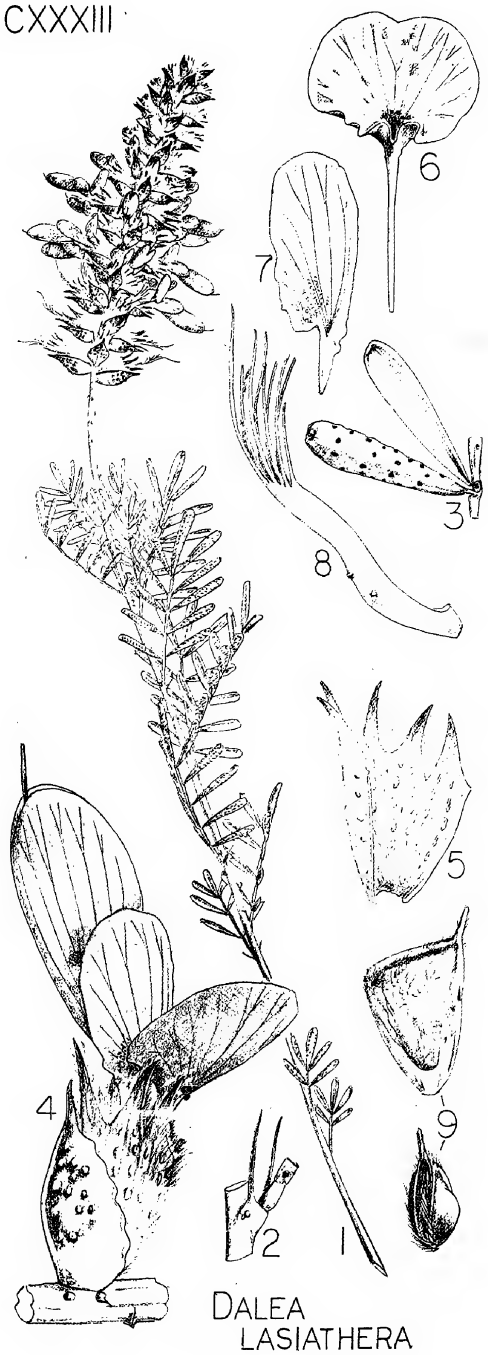
PLATE CXXXIII

Dalea pogonathera Gray and **D. lasiathera** Gray are deceptively alike, loosely tufted herbs glabrous up to the calyces, with glaucous, dotted foliage, persistent bracts pustular on the back, and flowers varying from rich purple to pale lilac. Compare, however, the long-toothed, plumose calyx of *D. pogonathera* with the short-toothed, silky-pilosulous one of *D. lasiathera*, of which the leaves, furthermore, have usually one or two more pairs of leaflets. The range of *D. pogonathera* extends over the arid basins and tablelands of northern Mexico from northern Zacatecas into southern Arizona, southern New Mexico, and in Texas to the trans-Pecos region and the Gulf Coast Plains. At lower elevations in southern Texas and adjoining Mexico the species is represented by a small-flowered (fig. 3a) var. **walkerae** (Tharp & Barkl.) B. L. Turner. The range of *D. lasiathera* is approximately coextensive with that of var. *walkerae*: in Texas it is found mostly on the Edwards Plateau, whence it extends only to northern Coahuila, northern Tamaulipas, and in Nuevo León south about to the latitude of Monterrey. A pod with dilated keel along the leading edge, shown only for *D. lasiathera* (fig. 9), is common to both species. Habit × 1; leaflets × 3; the rest × 5.

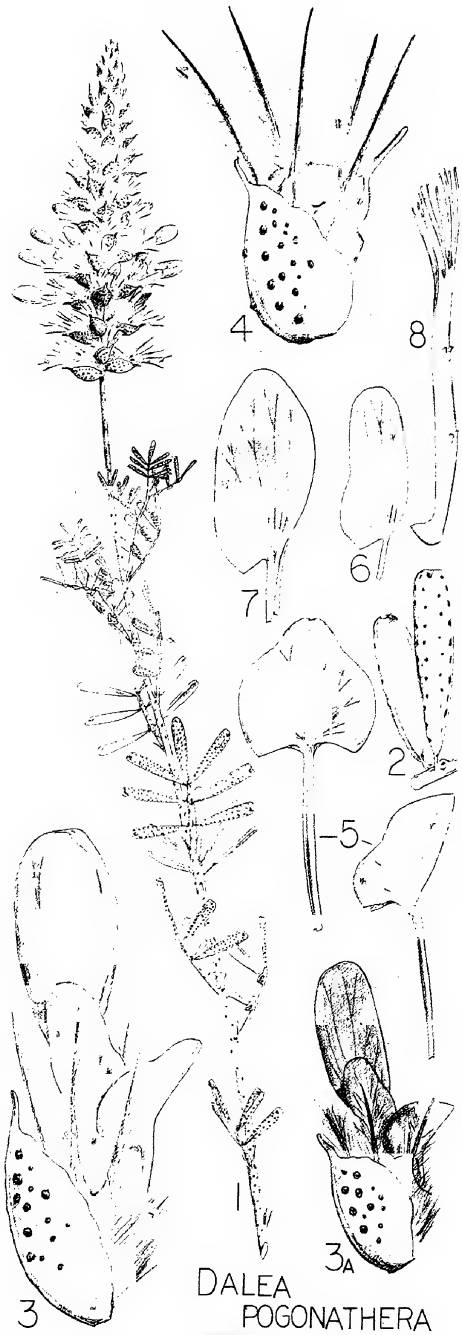
D. pogonathera: 1) stem; 2) leaflets; 3) flower of var. *pogonathera*; 3a) flower of var. *walkerae*; 4) fruiting calyx; 5) banner, ventral and profile view; 7) keel; 8) androecium.

D. lasiathera: 1) stem; 2) stipules; 3) leaflets; 4) flower; 5) calyx, laid open; 6) banner, ventral view; 7) wing; 8) androecium; 9) pod, profile and vertical views.

CXXXIII



DALEA
LASIATHERA



DALEA
POGONATHERA

PLATE CXXXIV

Dalea enneandra Nuttall, a tall virgate herb of United States prairies, ranging from Texas to North Dakota, w. into e. Wyoming, e. Colorado, and n.-e. New Mexico, e. into Iowa and n.-w. Missouri. The plant is glabrous except for silvery-plumose calyces, with erect stems branching distally into an effuse panicle of spikes. The glaucous, dotted foliage is deciduous after midsummer. The caducous petals are white except for a faint green eye-spot on the banner. Note the persistent bracts which enfold the calyx and fall with it, carrying the pod and its single seed on feathered sails. — Habit $\times$ 1; the rest $\times$ 5.

1) branch of the panicle; 2) leaf-base, showing stipules, pulvinus, and first joint of rachis with leaflet; 3) flower + bract; 4) calyx, laid open; 5) fruiting calyx + bract; 6) banner, ventral and profile views; 7) keel; 8) wing; 9) androecium; 10) pod.

CXXXIV

DALEA
ENNEANDRA

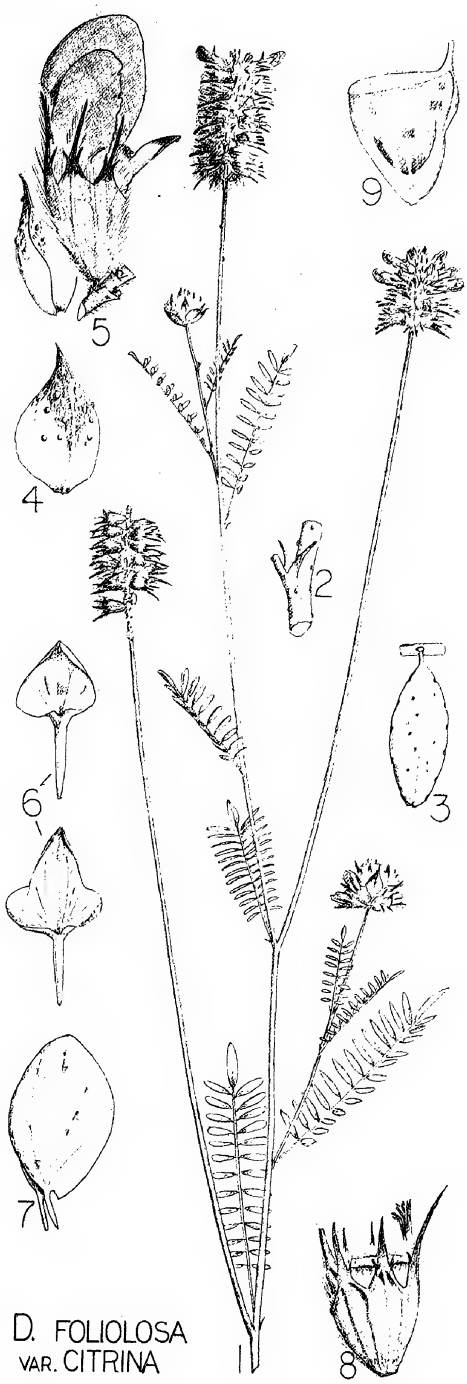
PLATE CXXXV

Dalea foliolosa (Ait.) Barneby is a polymorphic species, varying greatly in stature, length of calyx-teeth, and flower-color, but easily recognized by the combination of an annual root, glabrous foliage, short bracts with broad hyaline base enveloping the flower-buds, and a callous, crestlike keel along the pod's horizontal edge. As a native, though often as a roadside weed, it is widely dispersed over the Mexican plateau from southern Coahuila south into the highlands of Guatemala, and (as var. *citrina*) is adventive in northern South America. The var. **foliolosa**, which contains the more northern and southward the more montane aspects of the species, is of low stature, the stems, whether erect or prostrate, rarely surpassing 5 dm in length, and its calyx-teeth are deltate. It is the only variety found on the Mexican plateau. where the petals are commonly reddish-purple, but reappears in pine-forest southward, usually in forms with diffuse stem and bright blue flowers. The var. **citrina** has erect stems 4–10 dm long, at least one (the dorsal) calyx-tooth subulate-aristate, and flower nearly always bright blue except for the whitish banner. It is an abundant weed of grasslands and cornfields in the Neovolcanic Belt and Balsas depression, in the valley of Oaxaca, and sporadically southward. Stems × 1; the rest × 5.

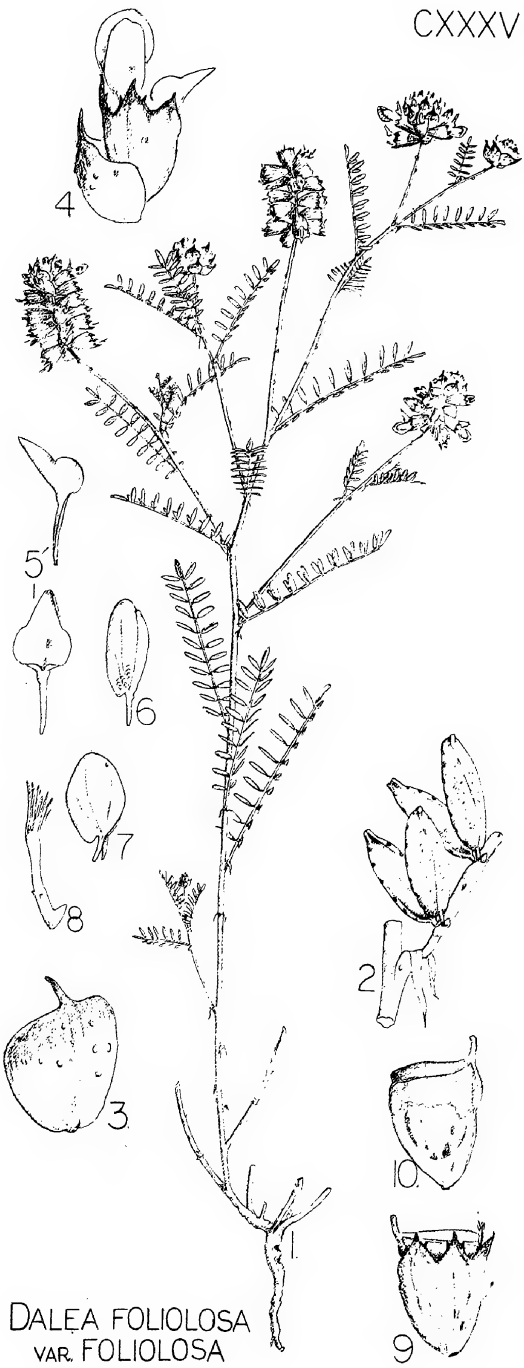
var. *foliolosa*: 1) stem; 2) stipules + leaflets; 3) bract, dorsal view; 4) flower + bract; 5) banner, profile and ventral views; 6) wing; 7) keel; 8) androecium; 9) fruiting calyx; 10) pod.

var. *citrina*: 1) upper part of stem; 2) stipules; 3) leaflet, dorsal view; 4) bract, dorsal view; 5) flower + bract; 6) banner, two types, both ventral view; 7) keel; 8) fruiting calyx; 9) pod.

CXXXV



D. FOLIOLOSA
VAR. CITRINA



DALEA FOLIOLOSA
VAR. FOLIOLOSA

PLATE CXXXVI

Dalea nana Torr., a lowly herb of dry grassland and desert hill country, widespread over much of Texas and northeastern Mexico, westward to southeastern Arizona and central Chihuahua. The mostly five-fingered leaves are gray- or silvery-pilose, the petals pale yellow turning pinkish-brown. The varieties are edaphic vicariants, var. **nana** (left) adapted to alluvial and wind-blown sands poor in soluble calcium, var. **carnescens** (Rydb.) K. & P. to base-rich soils derived from or overlying limestone. Stems × 1; the rest × 5.

var. *nana*: 1) stem; 2) stipules; 3) leaflets; 4) bracts, ventral and dorsal views; 5) flower; 6) fruiting calyx; 7) banner, ventral and profile views; 8) wing; 9) keel; 10) androecium.

var. *carnescens*: 11) upper part of stem; 12) lower bract, dorsal view; 13) upper bract, ventral view; 14) flower; 15) banner, ventral view; 16) keel; 17) fruiting calyx; 18) pod.

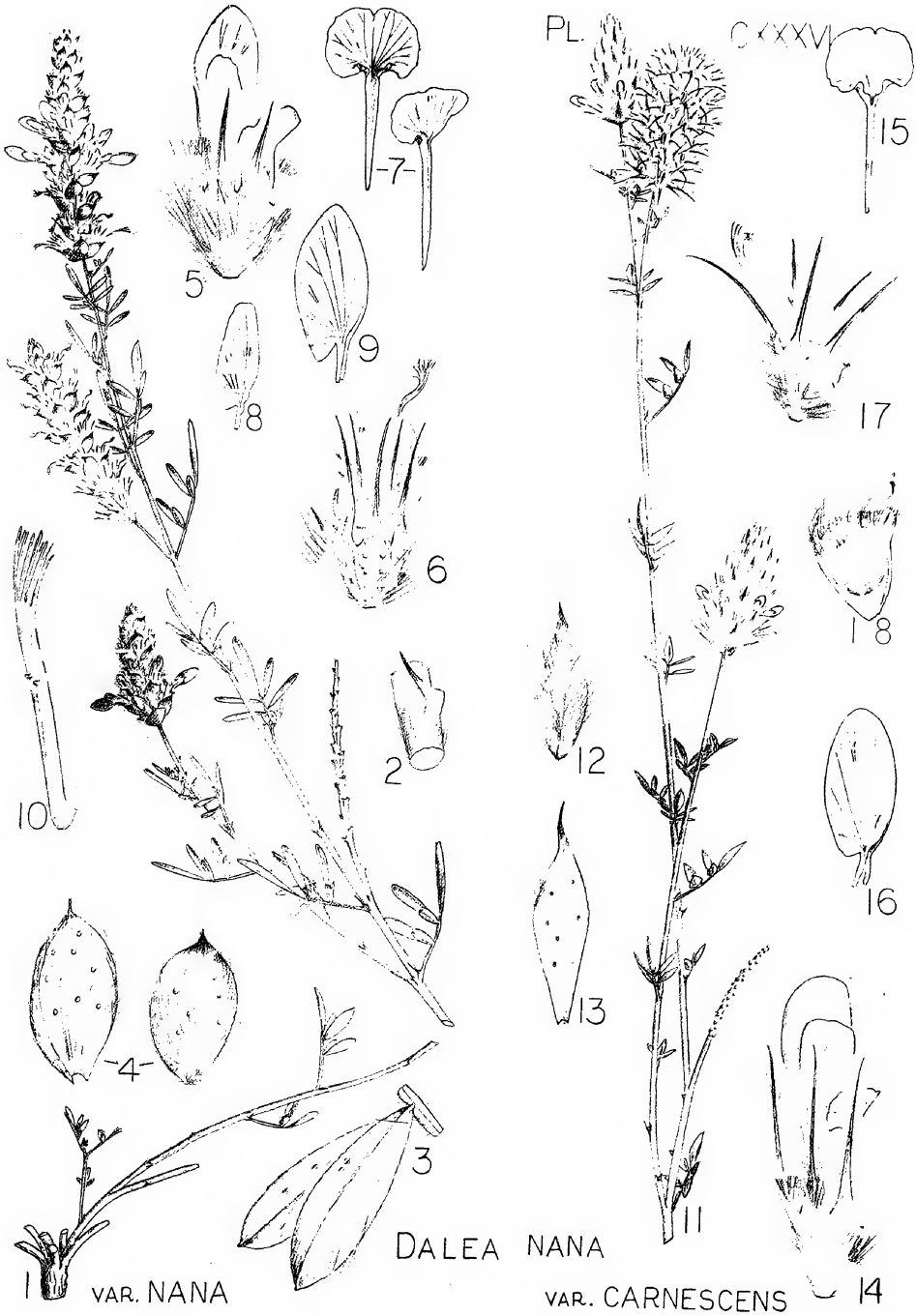

PL. CXXXVI
DALEA NANA
1 VAR. NANA
VAR. CARNESCENS 14

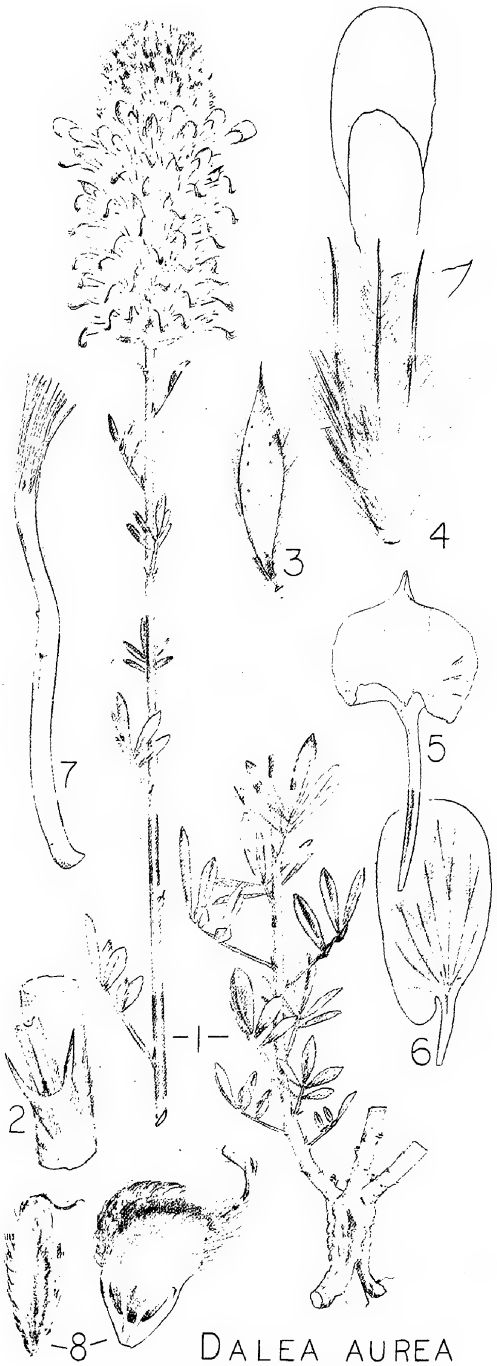
PLATE CXXXVII

Dalea aurea Nutt. and **D. boraginea** Barneby. The golden dalea, *D. aurea*, is an erect herb some 3–7 dm tall, its pinnately cinquefoil leaves gray with stiff, subappressed hairs. The virgate stems, rising solitary or few together from the root-stock, are commonly simple up to the one massive spike of silvery-barbate calyces, but sometimes branch distally, when each lateral branch terminates in a smaller conelike flower-head. The petals open clear but strong lemon-yellow, and unlike those of most *Aureae* do not turn brown or pinkish as they fade. The species is widely dispersed over the short-grass prairies of west-central United States and is common over much of Texas west of the timber belt, thence extending north, progressively rarer, to southwest South Dakota, west into the Pecos valley in New Mexico, and south into northern Coahuila and adjoining Chihuahua; local and disjunct in east-central Arizona. The related *D. boraginea*, remarkable for the spreading, almost hispid pubescence of the stems and setose calyces, resembles *D. aurea* in stature but has trefoil leaves. The intervals between the calyx-ribs are charged in *D. aurea* with a vertical row of about three small, round, honey-colored glands; in *D. boraginea* with a single long and narrow one. The epistemonous petals of *D. boraginea*, which is known only from the type-locality in east-central Coahuila, are still unknown but pretty certainly will prove to be of some shade of yellow. Stems and inflorescences × 1; the rest × 5.

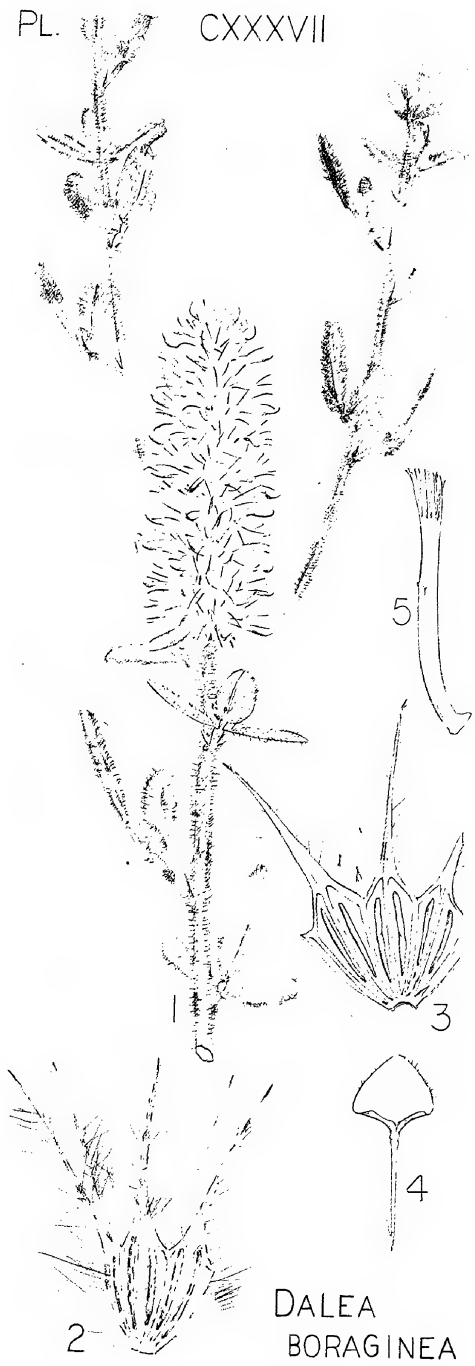
D. aurea: 1) base and summit of a stem 5 dm long; 2) stipules; 3) bract from middle of spike, ventral view; 4) flower; 5) banner, ventral view; 6) keel; 7) androecium; 8) pod, vertical and profile views.

D. boraginea: 1) summit of stem 5 dm tall; 2) fruiting calyx; 3) part of calyx laid open; 4) banner, ventral view; 5) androecium.

PL. CXXXVII



DALEA AUREA



DALEA BORAGINEA

PLATE CXXXVIII

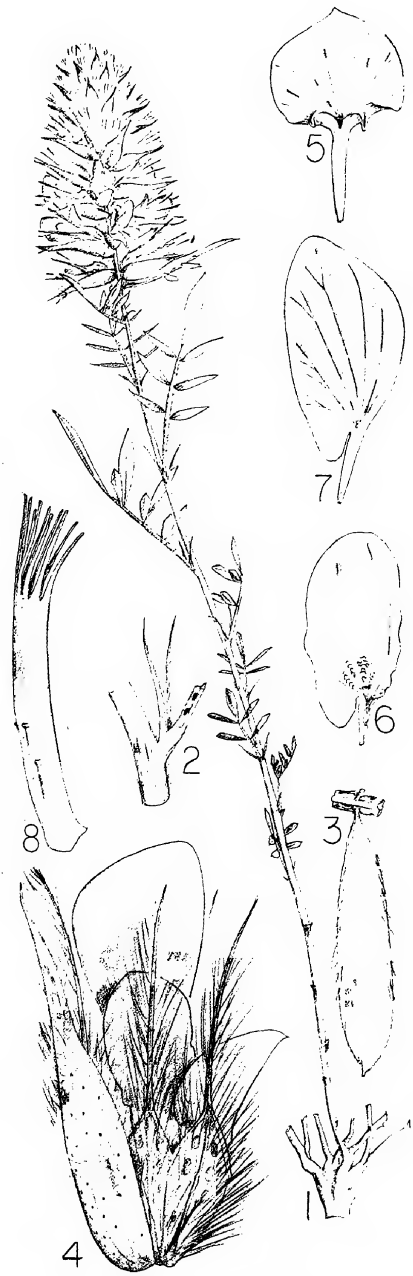
Dalea parrasana Bdg. and **D. wrightii** Gray are low herbs adapted to grama grassland transitional to desert, where they may flower either in spring or following summer rains. Although much alike in their 5–7-foliolate, gray-pilose leaves, broad spikes of plumose calyces and yellow petals that fade brown or pinkish, they differ greatly in size and proportions of the flower-parts. The common *D. wrightii* is found over most of Coahuila and eastern Chihuahua, and extends north and west into trans-Pecos Texas, southeastern Arizona, and adjoining Sonora. The rare *D. parrasana* is known certainly only from southern Coahuila, near Parras and Saltillo, but is believed to occur somewhere in San Luis Potosí. Habit × 1; the rest × 5.

D. parrasana: 1) stem; 2) stipules; 3) leaflet; 4) flower + bract; 5) banner, ventral view; 6) wing; 7) keel; 8) androecium.

D. wrightii: 1) stem; 2) lowermost bract, dorsal view; 3) flower + bract; 4) banner, ventral and profile views; 5) wing; 6) keel; 7) androecium.

CXXXVIII

D. WRIGHTII



DALEA PARRASANA

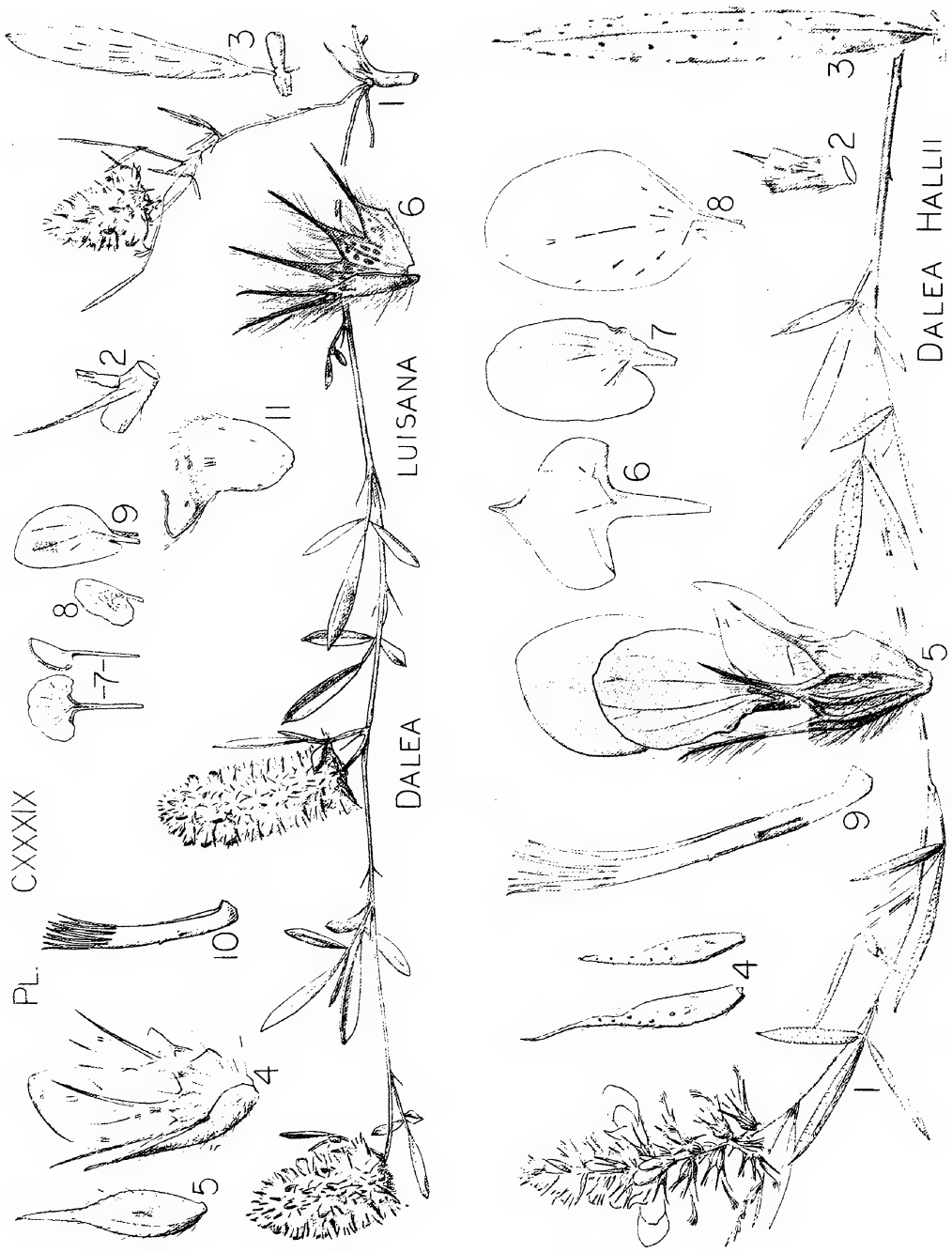

PL. CXXXIX
DALEA LUISANA
DALEA HALLII

PLATE CXXXIX

Dalea luisana Wats. and **D. hallii** Gray, slender, diffuse, herbaceous daleas with greenish but pilose, trefoil leaves and yellow flowers that turn brown in age. Both are calciphile and adapted to environment of arid grasslands, and can flower either in early summer or following rain in fall. The range of *D. luisana* extends over the eastern half of the Mexican plateau from southern Coahuila south into the Tehuacán desert in southern Puebla; *D. hallii* is endemic to east-central Texas where it is found on the Balcones escarpment and northward interruptedly, often on chalky soils, to the neighborhood of Dallas. Habit × 1; the rest × 5.

D. luisana: 1) flowering stem; 2) stipules 3) leaflet, dorsal view; 4) flower + bract; 5) bract, dorsal view; 6) calyx, laid open; 7) banner; 8) wing; 9) keel; 10) androecium; 11) pod.

D. hallii: 1) upper half of stem; 2) stipule; 3) leaflet, dorsal view; 4) bracts, profile view; 5) flower; 6) banner, ventral view; 7) wing; 8) keel; 9) androecium.

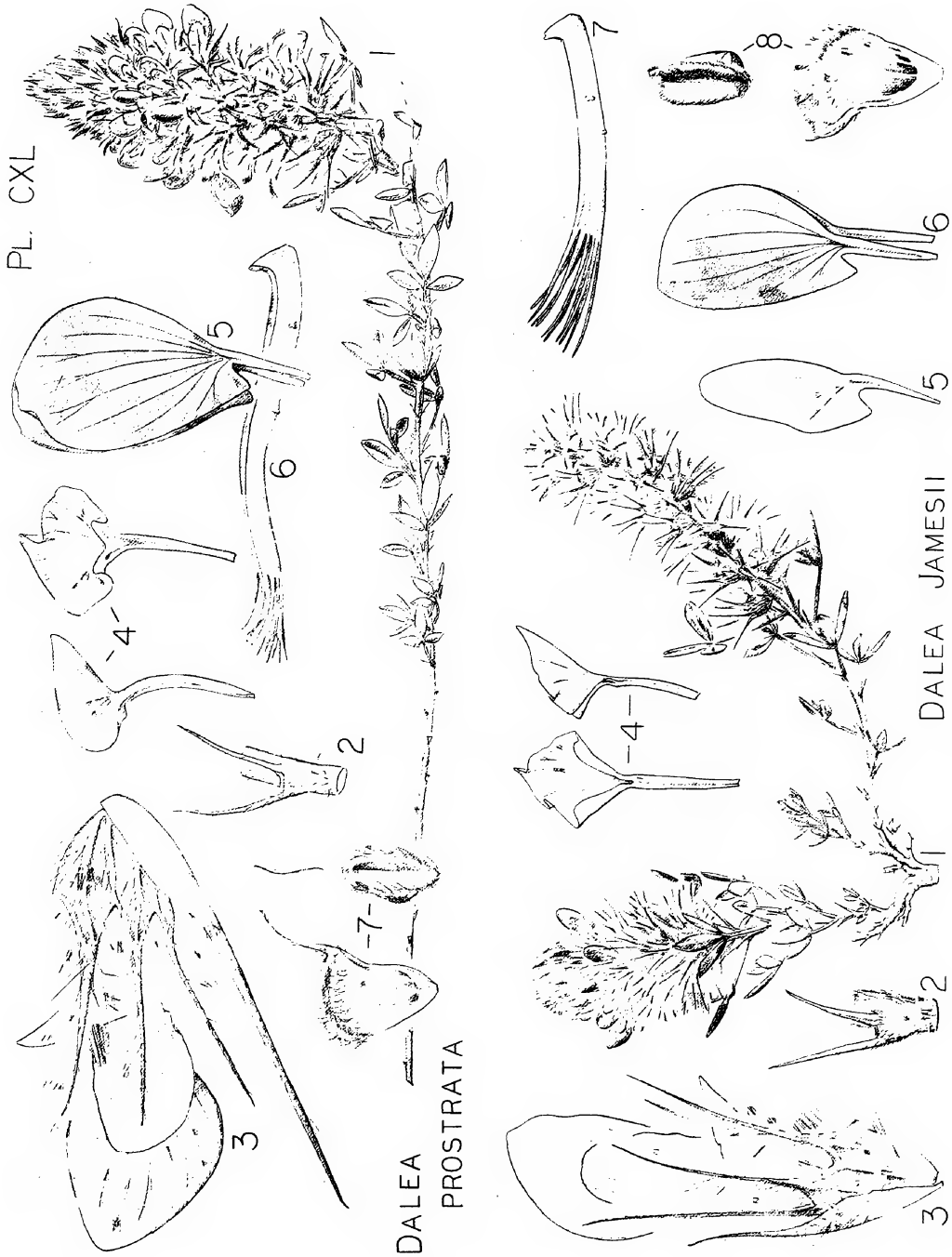

PL. CXL
DALEA PROSTRATA
DALEA JAMESII

PLATE CXL

Dalea jamesii (Torr.) T. & G. and **D. prostrata** Ort., low herbs of arid hill country and grama grasslands in southwestern United States and the Mexican plateau, are alike in their trifoliolate leaves and yellow flowers that fade orange- or pinkish-brown. The cespitose *D. jamesii* seldom reaches a full decimeter in height, has foliage silvery with subappressed hairs, and ranges from southeastern Colorado and the Oklahoma panhandle south and west through the Pecos and Rio Grande valleys into western Texas, southeastern Arizona, and interruptedly to southeastern Chihuahua. The related *D. prostrata* ranges southward from the limit of *D. jamesii* in Chihuahua to the Bajío country north of the Lerma River and to the Valley of Mexico, east into San Luis Potosí and Hidalgo. It differs in its much longer, pliantly humistrate leafy stems, greener foliage, and looser pilose pubescence. Habit × 1; the rest × 5.

D. jamesii: 1) habit; 2) stipules; 3) flower + bract; 4) banner, ventral and profile views; 5) wing; 6) keel; 7) androecium; 8) pod, vertical and profile views.

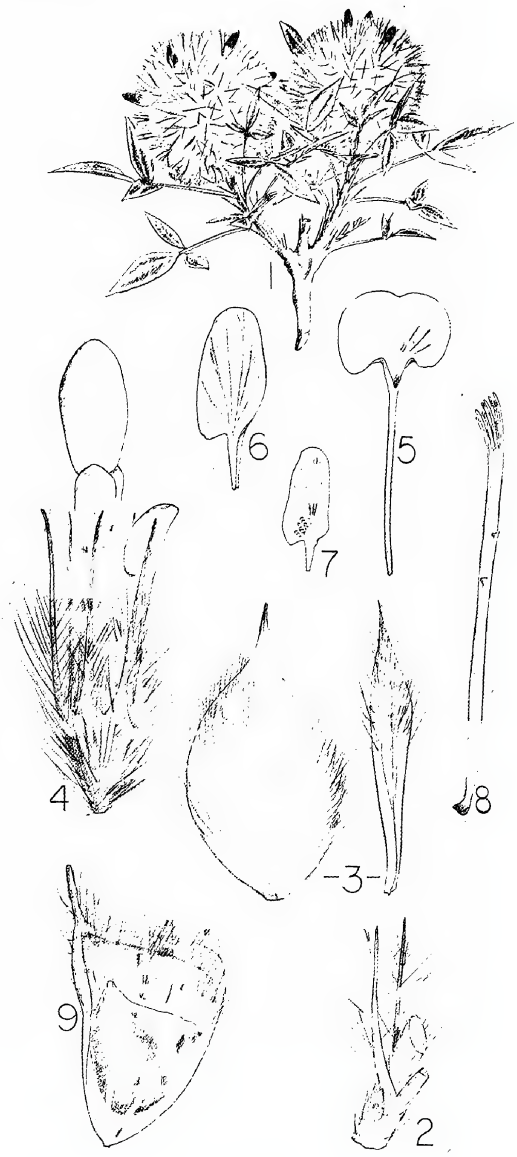
D. prostrata: 1) upper half of stem; 2) stipules; 3) flower + bract; 4) banner, profile and ventral views; 5) keel; 6) androecium; 7) pod, profile and vertical views.

PLATE CXLI

Dalea laniceps Barneby, a diminutive perennial herb with silvery trefoil foliage in which nestle the disproportionately large, globose or egg-shaped heads of pilose calyces, has like other members of sect. *Cylipogon* yellow petals that fade orange-brown and a pod heavily crested and barbate along the prow. Note the dimorphic bracts, the long-clawed banner, and the tiny epistemonous petals carried up on a column far beyond the orifice of the calyx. A species of wide but discontinuous dispersal over arid northern Mexico that extends north into trans-Pecos Texas and from 250 m on the first piedmont of Sierra Madre in Nuevo León up to about 2400 m in the grasslands of Durango and northern Zacatecas. — Habit × 1; pod × 10; the rest × 5.

1) habit; 2) stipules; 3) bracts, dorsal view, at left from the first series, at right from between flowers; 4) flower; 5) banner, ventral view; 6) wing; 7) keel; 8) androecium; 9) pod.

CXLI

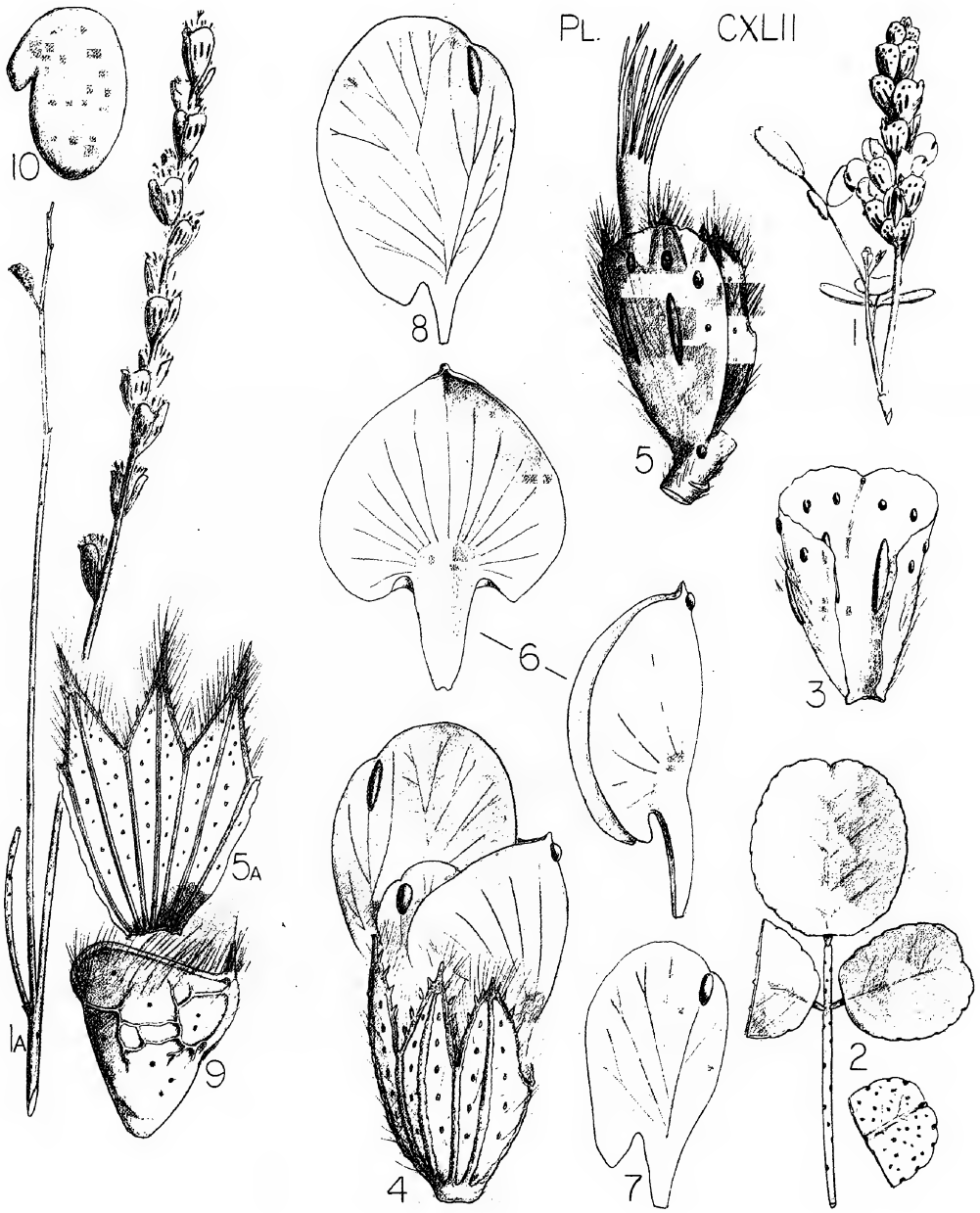


DALEA LANICEPS

PLATE CXLII

The extraordinary **Dalea trifoliata** Zucc. was collected twice during the first half of the XIX century, probably in Oaxaca, but has not been seen since, and nothing is known of its ecology or dispersal. It has the appearance of a highly modified xerophyte, and is to be looked for in desert valleys at low elevations, where it may be expected to flower from October onward. The plant is apparently shrubby, but of unknown stature, glabrous below the thinly pilose flower-spikes. Among the many unique features of *D. trifoliata* note: the pinnately trefoil leaves with coriaceous, drought-deciduous leaflets slightly peltate at the truncate base; stiff, virgate spikes that elongate after flowering; immense, persistent, broadly hyaline-margined bracts wrapped around the calyx; yellow petals apparently not discoloring in age but all tipped with a blister-gland; and the remarkably large pod and seed, the latter about 4 mm long. Inflorescences and main cauline leaf × 1; the rest × 5.

1) flowering raceme (from specimen cultivated at Munich); 1a) fruiting raceme, from Oaxaca (*Liebmann*); 2) main cauline leaf (one leaflet broken to show dorsal side); 3) bract, ventral view; 4) flower; 5) bract + faded flower, the petals lately fallen; 5a) part of calyx, laid open; 6) banner, ventral and profile views; 7) wing; 8) keel-petal; 9) pod; 10) seed.


PL. CXLII
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5A
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4
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1
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7
2

INDEX NOMINUM

(GENERA in large capitals; SUBGENERA, SECTIONES, SERIES and equivalent categories in large and small capitals; specific and (indented) infraspecific epithets in **roman boldface** if accepted, *italicized* if synonyms. Authors' names distinguish homonyms.)

AMORPHA
glandulosa = **Dalea cliffortiana**
ASAGRAEA = PSOROTHAMNUS sect. CAPNODENDRON
spinosa = **Psorothamnus spinosus**

CARROA = MARINA sect. CARROA
diffusa = **Marina diffusa diffusa**
glandulosa = praec.
CYLIPOGON = DALEA sect. CYLIPOGON
capitatum = **Dalea aurea**
virgatum = **D. enneandra**

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angustifolia = **D. cliffortiana**
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argentea (Mart.) = **D. tomentosa tomentosa**
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argyrostachya = **D. versicolor argyrostachya**
argyrotricha = **D. reclinata**
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arizonica = **D. lumholtzii**
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anthonyi = praec.
cinerea = **M. parryi**
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paucifolia = **D. scandens paucifolia**
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domingensis = praec.
emphysodes = praec.
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amoena = **Ps. arborescens pubescens**
johnsoni = **Ps. fremontii fremontii**
minutifolia = **Ps. arborescens minutifolius**
pubescens = **Ps. arborescens pubescens**
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gigantea = **D. lutea gigantea**
glaberrima = **D. lanata terminalis**
glabrescens = **D. versicolor glabrescens**
glandulosa (Merill) = **D. cliffortiana**
glandulosa (Shinners) = **D. phleoides phleoides**
goldmani = **Marina goldmani**
gracilis (H. & A.) = **M. diffusa diffusa**
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gracillima = **Marina gracillima**
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jamesii — p. 577, pl. CXL
jamesonii — p. 342, pl. LXXVIII
johnsoni = **Psorothamnus fremontii**
juncea = **Ps. junceus**
killipii = **D. ayavacensis killipii**
kingii = **Psorothamnus kingii**
kuhnistera = **D. pinnata pinnata**
kuntzei — p. 376, pl. LXXXV
lachnantha — Appendix I, p. 583
lachnostachya — p. 164, pl. XXXIV
laevigata (Gray) = **D. grayi**
laevigata (S. & M.) = **D. bicolor bicolor**
lagopina = **D. polystachya**
lagopus = **D. leporina**
lamprostachya — p. 471, pl. CXIII
lanata (Don) = **D. zimapanica**
lanata (Spreng.) — p. 280
lanata — p. 281, pl. LXII
terminalis — p. 282, pl. LXII
laniceps — p. 579, pl. CXLI
lanuginosa = **D. lanata lanata**
lasiathera — p. 551, pl. CXXXIII
lasiostachya = **D. versicolor involuta**
laxiflora (Pursh) = **D. enneandra**
pumila = praec.
laxiflora (Schlechtd.) = **D. hegewischiana**
lemmoni = **D. brachystachya**
leporina — p. 210, pl. XLVIII
alba = **D. leporina**
leptostachya — p. 504, pl. CXIII
leucantha = **D. versicolor argyrostachya**
leucosericea — p. 407, p. XCV
leucostachya — p. 286
eysenhardtioides — p. 287, pl. LXIII
leucostachya — p. 288, pl. LXIII
leucostoma = **D. lutea lutea**
linnaei = **D. cliffortiana**, p. p., **D. leporina**, p. p.
lloydii = **D. capitata capitata**
loesenerana = **D. leucosericea**
longipila = **D. neo-mexicana longipila**
longispicata = **D. coerulea longispicata**
lucida = **D. urceolata lucida**
luisana — p. 573, pl. CXXXIX
lumholtzii — p. 172, pl. XXXVI
lutea — p. 475
arsenei — p. 479
gigantea — p. 480, pl. CXV
lutea — p. 477, pl. CXV

DALEA (*Cont.*)
macrostachya = **D. coerulea longispicata**
macrotropis — p. 436, pl. CIV
maritima = **Marina maritima**
mcvaughii — p. 318, pl. LXIX
megacarpa = **Errazurizia megacarpa**
biuncifera = **E. benthami**
megalostachya = **D. bicolor orcuttiana**
melantha — p. 481
berlandieri — p. 484, pl. CXVII
cineracea — p. 485, pl. CXVII
melantha — p. 483, pl. CXVI
pubens — p. 485
mexiae — p. 455, pl. CIX
microphylla = **D. carthagenensis brevis**
brevis = praec.
vicina = praec.
minor = **Marina minor**
minutiflora = **M. minutiflora**
minutifolia — p. 440, pl. CV
mixteca — p. 335, pl. LXXV
mollis — p. 160, pl. XXXIII
longipila = **D. neo-mexicana longipila**
mollissima = **D. mollissima**
neo-mexicana = **D. neo-mexicana neo-mexicana**
pilosa = **D. mollis**
mollissima — p. 163, pl. XXXIII
moquehuana — p. 390, pl. CXXX
moricandi — Append. I, p. 584
mucronata — p. 396, pl. XCII
multiflora — p. 250, pl. LV
mutabilis = **D. obovatifolia obovatifolia**
mutisii = **D. coerulea coerulea**
myriadenia — p. 364, pl. LXXXIII
nana — p. 563
carnescens — p. 565, pl. CXXXVI
elatior = praec.
nana — p. 564, pl. CXXXVI
naviculifolia = **D. bicolor naviculifolia**
neglecta = **Marina neglecta neglecta**
nelsonii — p. 183, pl. XXXIX
nemaphyllidia — p. 319, pl. LXVIII
neo-mexicana — p. 156
longipila — p. 158, pl. XXXI
megaladenia — p. 159, pl. XXXII
mollissima = **D. mollissima**
neo-mexicana — p. 157, pl. XXXI
nigra = **D. cliffortiana**
nobilis — p. 313, pl. LXVI
nova = **D. cylindrica nova**
nummularia = **Psorothamnus polydenius jonesii**
nutans = **Marina nutans**
oaxacana = **virgata**
obovata — p. 224, pl. LI
obovatifolia — p. 331

DALEA (*Cont.*)
obovatifolia — p. 333, pl. LXXIV
uncifera — p. 334, pl. LXXIV
obreniformis — p. 196, pl. XLIII
occidentalis = **D. scandens occidentalis**
oligophylla = **D. candida oligophylla**
onobrychioides = **D. elegans onobrychioides**
onobrychis — p. 369, pl. LXXXV
orcuttii = **Marina orcuttii**
ordiae = **D. albiflora**
oreophila = **D. leporina**
ornata — p. 228, pl. LII
ovalifolia (G. Don) = **D. leptostachya**
ovalifolia (Ort.) = **D. lutea lutea**
painteri = **D. lutea lutea**
palmeri = **Marina palmeri**
parrasana — p. 570, pl. CXXXVIII
parryi = **Marina parryi**
parviflora — Appendix III, p. 587
parvifolia = **D. tenuicaulis**
pazensis — p. 375, pl. LXXXVIII
vargasii = **D. smithii**
pectinata — p. 320, pl. LXX
pedunculata — Appendix I, p. 584
penicillata = **D. enneandra**
peninsularis = **Marina peninsularis**
pennellii — p. 370, pl. LXXXVII
peruviana = **D. exilis**
phleoides — p. 241
microphylla — p. 244, pl. LIV
phleoides — p. 243, pl. LIV
phymatodes = **D. carthagenensis carthagenensis**
pilifera = **D. reclinata**
pilocarpa = **D. carthagenensis pilocarpa**
pilosissima = **D. cyanea cyanea**
pinetorum — p. 469
anilantha — p. 470, pl. CXIII
pinetorum — p. 470, pl. CXIII
pinnata — p. 276
adenopoda — p. 279, pl. LXI
pinnata — p. 278, pl. LXI
trifoliata — p. 278, pl. LXI
piptostegia — p. 419, pl. XCVIII
plantaginoides — p. 198, pl. XLIV
platystegia = **D. foliolosa foliolosa**
plumosa = **D. lutea lutea**
pogonathera — p. 547
pogonathera — p. 549, pl. CXXXIII
walkerae — p. 550, pl. CXXXIII
polydenia = **Psorothamnus polydenius**
subnuda = praec.
polycephala = **D. minutifolia**
polygonoides — p. 207, pl. XLVII
anomala = praec.
laevituba = praec.

DALEA (*Cont.*)
polyphylla = **D. foliolosa foliolosa**
polystachya — p. 314, pl. LXVII
pringlei — p. 178
multijuga — p. 181, pl. XXXVIII
oxyphyllidia — p. 182, pl. XXXIX
pringlei — p. 180, pl. XXXVIII
procumbens = **Marina procumbens**
prostrata — p. 575, pl. CXL
psoraleoides = **D. tomentosa psoraleoides**
pueblensis = **Marina pueblensis**
pulchella (G. Don) — p. 448, pl. CVII
pulchella (Moric.) = **D. dorycnioides**
pulcherrima = **Marina nutans**
pulchra — p. 415, pl. XCVII
pumila = **D. cliffortiana**
purpurea — p. 262
albiflora = **D. purpurea purpurea**
arenicola — p. 266, pl. LVIII
purpurea — p. 265, pl. LVIII
tenuis = **D. tenuis**
purpusi — p. 500, pl. CXXII
pyramidalis = **D. virgata**
querceti — Appendix I, p. 585
quercetorum — p. 338, pl. LXXVI
quinqueflora = **D. capitata quinqueflora**
radicans — p. 464, pl. CXI
ramosissima (Benth.) = **D. brandegei**
ramosissima (M. & G.) = **Marina diffusa diffusa**
reclinata — p. 536, pl. CXXXI
retusifolia = **D. boliviana**
reverchoni — p. 271, pl. LIX
revoluta — p. 177, pl. XXXVII
robusta = **D. cliffortiana**
rosea = **D. hegewischiana**
roseiflora = **D. polystachya**
roseola = **D. foliolosa foliolosa**
rubescens = **D. nana carnescens**
rubricaulis = **D. kuntzei**
rubrolutea — p. 185, pl. XL
rydbergii = **D. albiflora**
rzedowskii — p. 309, pl. LXV
sabinalis — p. 240, pl. LIV
sabulicola = **D. wrightii**
saffordii — p. 466, pl. CX
samancoensis = **D. cylindrica cylindrica**
saundersii = **Psorothamnus arborescens arborescens**
sawadae = **D. cylindrica nova**
scandens — p. 525
gaumeri — p. 530, pl. CXXIX
occidentalis — p. 528, pl. CXXIX
paucifolia — p. 526, pl. CXXIX
scandens — p. 529, pl. CXXIX
vulneraria — p. 527, pl. CXXIX
scariosa — p. 237, pl. LIII

DALEA (*Cont.*)
scoparia = **Psorothamnus scoparius**
subrosea = praec.
schaffneri = **D. hegewischiana**
schotti = **Psorothamnus schottii**
puberula = praec.
searlsiae — p. 232, pl. LIII
seemanni = **D. bicolor bicolor**
trochilina = **D. trochilina**
seleriana — Appendix I, p. 585
sericea — p. 541
humistrata — p. 544, pl. CXXXII
sericea — p. 543, pl. CXXXII
sericocalyx — p. 502, pl. CXXIII
sericophylla = **D. weberbaueri sericophylla**
sessilis = **D. versicolor sessilis**
similis — p. 324, pl. LXX
simulatrix — p. 154, pl. XXX
smithii — p. 373, pl. LXXXVII
spiciformis = **Marina spiciformis**
spinosa = **Psorothamnus spinosus**
stanfieldii = **D. tenuis**
stenophylla = **D. elegans elegans**
submontana = **Marina nutans**
subulicola = **Dalea sabulicola**
subvillosa = **D. lanata terminalis**
sulfurea = **D. cylindrica sulfurea**
surotatensis = **D. versicolor calcarata**
tapacariensis — p. 388, pl. LXXVI
tehuacana = **D. carthagenensis capitulata**
tentaculoides — p. 467, pl. CXXI
tenuicaulis — p. 524, pl. CXXVIII
goniocymbe = praec.
tenuifolia — p. 274, pl. LX
tenuis — p. 270, pl. LIX
tephrosioides — Appendix III, p. 587
terminalis = **D. lanata terminalis**
ternata = **D. luisana**
thompsonae = **Psorothamnus thompsonae**
thouini — p. 206, pl. XLVII
thymoides = **D. bicolor bicolor**
thyrsiflora = **D. scandens paucifolia**
tinctoria = **Psorothamnus emoryi arenarius**
arenaria = praec.
tolteca — p. 512, pl. CXXIV
tomentosa — p. 401
mota — p. 405, pl. XCIV
psoraleoides — p. 404, pl. XCIV
tomentosa — p. 403, pl. XCIV
transiens — p. 219, pl. L
trifoliata — p. 581, pl. CXLII
trifoliolata = **D. prostrata**
trichocalyx = **D. carthagenensis trichocalyx**
triphylla = **D. prostrata**
trochilina — p. 434, pl. CIII

DALEA (*Cont.*)
tuberculata = **D. bicolor bicolor**
tuberculina = **D. bicolor bicolor**
uncifera = **D. obovatifolia uncifera**
unifoliolata = **Marina unifoliolata**
urceolata — p. 216
lucida — p. 218, pl. XLIX
tripetala — p. 219, pl. XLIX
urceolata — p. 218, pl. XLIX
variegata = **Marina divaricata**
verbenacea = **D. tomentosa tomentosa**
sericea = praec.
verna — p. 153, pl. XXX
vernicia = **D. foliolosa citrina**
verrucosa = **D. bicolor bicolor**
versicolor — p. 486
argyrostachya — p. 497, pl. CXX
calcarata — p. 492, pl. CXIX
decipiens — p. 491, pl. CXIX
glabrescens — p. 492, pl. CXXI
involuta — p. 496, pl. CXX
sessilis — p. 493, pl. CXIX
tsugoides = **versicolor versicolor**
versicolor — p. 489, pl. CXVIII
vetula = **Marina vetula**
villosa — p. 259
grisea — p. 262, pl. LVI
villosa — p. 261, pl. LVI
violacea = **D. purpurea purpurea**
virgata (Lag.) — p. 326, pl. LXXII
virgata (Micheli) = **D. cliffortiana**
viridiflora — p. 289, pl. XL
vulcanicola = **D. tomentosa psoraleoides**
vulneraria = **D. scandens vulneraria**
barbata = **D. carthagenensis barbata**
brevidens = praec.
typica = **D. scandens vulneraria**
watsoni = **D. albiflora**
weberbaueri — p. 365
sericophylla — p. 367, pl. LXXXII
weberbaueri — p. 366, pl. LXXXII
whitingi = **Psorothamnus thompsonae whitingi**
wigginsii — p. 463, pl. CXI
wislizeni = **D. versicolor glabrescens**
calcarata = **D. versicolor calcarata**
glabrescens = **D. versicolor glabrescens**
sanctae-crucis = **D. versicolor sessilis**
sessilis = **D. versicolor sessilis**
wrightii — p. 571, pl. CXXXVIII
zimapanica — p. 509, pl. CXXIV
zuccarinii = **D. trifoliata**

ERRAZURIZIA — p. 13
sect. ERRAZURIZIA — p. 14
sect. EXOSTEMON — p. 19

ERRAZURIZIA (*Cont.*)
sect. PSOROBATUS — p. 18
benthami — p. 18, pl. II
glandulifera = **E. multifoliolata**
megacarpa — p. 16, pl. I
multifoliolata — p. 15, pl. I
rotundata — p. 20, pl. II

GALEGA
coerulea = **Dalea coerulea coerulea**
GATESIA = DALEA ser. KUHNISTERA
alabamensis = **Dalea pinnata trifoliata**

JAMESIA = DALEA sect. CYLIPOGON
obovata = **Dalea jamesii**

KUHNIA
pinnata = **Dalea pinnata pinnata**
KUHNIASTERA = KUHNISTERA
KUHNISTERA = DALEA sect. KUHNISTERA
adenopoda = **Dalea pinnata adenopoda**
agastachya = **D. obovata**
candida = **D. candida candida**
diffusa = **D. candida oligophylla**
multiflora = **D. multiflora**
occidentalis = **D. candida oligophylla**
carnea = **D. carnea**
caroliniensis = **D. pinnata pinnata**
compacta = **D. compacta compacta**
decumbens = praec.
emarginata = **D. emarginata**
exilis = **D. exigua**
feayi = **D. feayi**
flavescens = **D. flavescens**
foliosa = **D. foliosa**
gattingeri = **D. gattingeri**
gracilis = **D. carnea gracilis**
grisea = **D. villosa grisea**
microphylla = **D. phleoides microphylla**
multiflora = **D. multiflora**
obovata = **D. obovata**
occidentalis = **D. candida oligophylla**
oligophylla = **D. candida oligophylla**
ornata = **D. ornata**
phleoides = **D. phleoides phleoides**
pinnata = **D. pinnata pinnata**
pulcherrima = **D. compacta pubescens**
purpurea = **D. purpurea purpurea**
reverchoni = **D. reverchoni**
rosea = **D. carnea carnea**
sabinalis = **D. sabinalis**
searlsiae = **D. searlsiae**
tenuifolia = **D. tenuifolia**
tenuis = **D. tenuis**
truncata = **D. pinnata adenopoda**
villosa = **D. villosa villosa**

KUHNISTERA (*Cont.*)
violacea = **D. purpurea purpurea**

MARINA — p. 55
sect. CARROA — p. 119
sect. MARINA — p. 66
ser. CHRYSORRHIZAE — p. 66
ser. CRENULATAE — p. 110
ser. GEMMEAE — p. 96
ser. MARINA — p. 108
ser. UNIFOLIOLATAE — p. 98
ser. VETULAE — p. 94
alamosana — p. 81, pl. XIII
calycosa — p. 82, pl. XIV
capensis — p. 76, pl. XI
catalinae — p. 74, pl. X
chrysorrhiza — p. 91, pl. XVI
crenulata — p. 114
crenulata — p. 115, pl. XXI
stipulacea — p. 116, pl. XXI
diffusa — p. 123
diffusa — p. 125, pl. XXIV
radiolata — p. 127, pl. XXIV
dispansa — p. 116, pl. XXII
divaricata — p. 69, pl. IX
evanescens — p. 92, pl. XVII
gemmea — p. 97, pl. XXII
ghiesbreghtii — p. 122, pl. XXIII
goldmani — p. 79, pl. XIII
gracilis — p. 108, pl. XVII
gracillima — p. 127, pl. XXV
grammadenia — p. 131, pl. XXVII
greenmaniana — p. 106
greenmaniana — p. 107, pl. XX
muelleri — p. 107, pl. XX
holwayi — p. 98, pl. XVI
interstes — p. 89, pl. XV
maritima — p. 72, pl. IX
melilotina — p. 100, pl. XVIII
minor — p. 78, pl. XII
minutiflora — p. 129, pl. XXVI
neglecta — p. 110
elongata — p. 113, pl. XIX
neglecta — p. 112, pl. XIX
nutans — p. 119, pl. XXIII
oculata — p. 73, pl. X
orcuttii — p. 84
campanea — p. 85
orcuttii — p. 85, pl. XIV
palmeri — p. 75, pl. VIII
parryi — p. 66, pl. VIII
peninsularis — p. 88, pl. XV
procumbens — p. 86, pl. XII
pueblensis — p. 102, pl. XVIII
sarodes — p. 117, pl. XXI
scopa — p. 132, pl. XXVIII

MARINA (*Cont.*)
spiciformis — p. 103, pl. XIX
stilligera — p. 130, pl. XXVI
unifoliolata — p. 104, pl. XX
vetula — p. 95, pl. XI

PAROSELA = DALEA sect. Parosela
subgen. *EUPAROSELA* = DALEA sect. Parosela
subgen. *THORNBERA* = DALEA sect. Thornbera
subgen. *TRICHOPODIUM* = MARINA sect. Carroa
ser. *ACUTIFOLIAE* = DALEA ser. Leptostachyae
ser. *ALOPECUROIDES* = DALEA ser. Urceolatae
ser. *ARENARIAE* = DALEA sect. Elaspora
ser. *AUREAE* = DALEA sect. Cylipogon
ser. *CALYCOSAE* = MARINA ser. Chrysorrhizae
ser. *CAPITATAE* = DALEA sect. Tuberculatae
ser. *CHRYSORRHIZAE* = MARINA ser. Chrysorrhizae
ser. *CITRIODORAE* = DALEA ser. Citriodorae
ser. *CRASSIFOLIAE* = DALEA ser. Pectinatae
ser. *CYANEAE* = DALEA ser. Cyaneae
ser. *DELICATAE* = MARINA ser. Marina
ser. *DIFFUSAE* = MARINA sect. Carroa
ser. *DIVARICATAE* = MARINA ser. Chrysorrhizae
ser. *EYSENHARDTIOIDES* = DALEA sect. Prosalea
ser. *FLAVAE* = DALEA ser. Flavae
ser. *FORMOSAE* = DALEA ser. Versicolores
ser. *FRUTESCENTES* = DALEA ser. Lasiostomae
ser. *LACHNOSTACHYDES* = DALEA ser. Lachnostachyae
ser. *LAGOPODES* = DALEA ser. Urceolatae
ser. *LASIOSTACHYAE* = DALEA ser. Versicolores
ser. *LASIOSTOMAE* = DALEA ser. Lasiostomae
ser. *LEUCOSTOMAE* = DALEA ser. Versicolores
ser. *LUMHOLTZIANAE* = DALEA ser. Thornbera
ser. *MICROPHYLLAE* = DALEA ser. Thyrsiflorae

PAROSELA (*Cont.*)
ser. *MUCRONATAE* = DALEA ser. Mucronatae
ser. *PECTINATAE* = DALEA ser. Pectinatae
ser. *PILOSISSIMAE* = DALEA ser. Cyaneae
ser. *POGONATHERAE* = DALEA ser. Psoropogon
ser. *POLYGONOIDES* = DALEA ser. Polygonoides
ser. *PSORALEOIDES* = DALEA ser. Psoraleoides
ser. *SERICEAE* = DALEA ser. Sericeae
ser. *SIMILES* = DALEA ser. Pectinatae
ser. *THYRSIFLORAE* = DALEA ser. Thyrsiflorae
ser. *TUBERCULATAE* = DALEA ser. Tuberculatae
ser. *UNCIFERAE* = DALEA ser. Parosela
ser. *UNIFOLIATAE* = MARINA ser. Unifoliolatae
ser. *URCEOLATAE* = DALEA ser. Urceolatae
ser. *VERSICOLORES* = DALEA ser. Versicolores
ser. *VETULAE* = MARINA ser. Vetulae
abietifolia = **Dalea abietifolia**
acutifolia = **D. cliffortiana**
alamosana = **Marina alamosana**
albiflora = **Dalea albiflora**
alopecuroides = **D. leporina**
amoena = **Psorothamnus arborescens pubescens**
anthonyi = **Marina divaricata**
arborescens = **Psorothamnus arborescens**
arenaria = **Ps. emoryi arenarius**
argyrea = **Dalea bicolor argyrea**
argyrostachya = **D. versicolor argyrostachya**
arizonica = **D. lumholtzii**
arsenei = **D. lutea arsenei**
astragalina = **D. coerulea coerulea**
atrocyanea = **D. botterii atrocyanea**
attenuata = **D. obovatifolia uncifera**
ayavacensis = **D. ayavacensis**
aurea = **D. aurea**
azurea = **D. azurea**
barbata = **D. carthagenensis barbata**
barberi = **D. urceolata urceolata**
berlandieri = **D. lutea berlandieri**
bicolor = **D. bicolor**
bigelovii = **D. leporina**
boliviana = **D. boliviana**
herrerae = praec.
botterii = **D. botterii**

PAROSELA (*Cont.*)
brachystachya = **D. brachystachya**
brandegei = **D. brandegei**
californica = **Psorothamnus arborescens simplifolius**
simplifolia = praec.
calliantha = **Dalea boliviana**
calocalyx = **D. cylindrica cylindrica**
calycosa = **Marina calycosa**
campylostachya = **Dalea hegewischiana**
canescens = **D. bicolor canescens**
capitata = **D. capitata**
capitulata = **D. carthagenensis capitulata**
carnescens = **D. nana carnescens**
carthagenensis = **D. carthagenensis**
catatona = **D. cylindrica haenkeana**
caudata (Rydb.) = **D. lutea lutea**
caudata = (Rydb., bis) = **D. obovatifolia uncifera**
chrysorrhiza = **Marina chrysorrhiza**
citrina = **Dalea foliolosa citrina**
citriodora = **D. foliolosa foliolosa**
cliffortiana = **D. cliffortiana**
coerulea = **D. coerulea**
conzattii = **D. virgata**
costaricana = **D. leporina**
crassifolia = **D. crassifolia**
crenulata = **Marina crenulata**
cyanea = **Dalea cyanea**
cylindrica = **D. cylindrica**
dalea = **D. cliffortiana**
robusta = praec.
decora = **D. dorycnioides**
delicata = **Marina gracilis**
dentata = **Psorothamnus emoryi arenarius**
diffusa = **Marina diffusa**
dispansa = **M. dispansa**
divaricata = **M. divaricata**
cinerea = **M. parryi**
diversicolor = **Dalea zimapanica**
domingensis = **D. carthagenensis**
dorycnioides = **D. dorycnioides**
elata = **D. elata**
elatior = **D. nana carnescens**
elongata = **Marina neglecta elongata**
emoryi = **Psorothamnus emoryi emoryi**
arenaria = **Ps. emoryi arenarius**
juncea = **Ps. emoryi emoryi**
emphysodes = **Dalea carthagenensis**
enneandra = **D. enneandra**
eosina = **D. elegans onobrychioides**
eriophylla = **D. eriophylla**
ervoides = **D. humilis**
erythrorrhiza = **D. erythrorrhiza**
exilis = **D. exilis**
exserta = **D. exserta**

PAROSELA (*Cont.*)
eysenhardtioides = **D. leucostachya eysenhardtioides**
fieldii = **D. fieldii**
filiciformis = **D. filiciformis**
filiformis = **D. filiformis**
fissa = **D. cyanea fissa**
flava = **D. elata**
floridana = **D. carthagenensis floridana**
formosa = **D. formosa**
fremontii = **Psorothamnus fremontii**
johnsonii = **Ps. fremontii fremontii**
saundersii = **Ps. arborescens arborescens**
wheeleri = **Ps. arborescens minutifolia**
frutescens = **Dalea frutescens**
fulvosericea = **D. greggii**
fuscescens = **D. melantha melantha**
galbina = **D. galbina**
gaumeri = **D. scandens gaumeri**
gigantea = **D. lutea gigantea**
glaberrima = **D. lanata terminalis**
glabrescens = **D. versicolor glabrescens**
goldmani = **Marina goldmani**
gracilis = **Dalea sericea sericea**
gracillima = **Marina gracillima**
grayi = **Dalea grayi**
greenmaniana = **Marina greenmaniana**
greggii = **Dalea greggii**
hallii = **D. hallii**
hegewischiana = **D. hegewischiana**
hemsleyana = **D. hemsleyana**
hofstenii = **D. boliviana**
holwayi = **Marina holwayi**
hospes = **Dalea hospes**
humifusa = **D. humifusa**
anatona = praec.
humilis = **D. scandens paucifolia**
inconspicua = **D. humilis**
insignis = **D. insignis**
involuta = **D. versicolor involuta**
jamesii = **D. jamesii**
jamesonii = **D. jamesonii**
johnsonii = **Psorothamnus fremontii fremontii**
minutifolia = **Ps. arborescens minutifolia**
pubescens = **Ps. arborescens pubescens**
saundersii = **Ps. arborescens arborescens**
juncea = **Ps. emoryi emoryi**
killipii = **Dalea ayavacensis killipii**
kingii = **Psorothamnus kingii**
kuntzei = **Dalea kuntzei**
lachnostachya = **D. lachnostachya**
laevigata = **D. bicolor bicolor**
lagopina = **D. polystachya**
lagopus = **D. leporina**, p. p., **D. exserta**, p. p.
lanata = **D. lanata**
lasiathera = **D. lasiathera**

PAROSELA (*Cont.*)

lasiostachya = **D. versicolor involuta**
glabrescens = **D. versicolor glabrescens**
involuta = **D. versicolor involuta**
lasiostoma = **D. hegewischiana**
laxa = **D. frutescens**
laxiflora = **D. hegewischiana**
lemmoni = **D. brachystachya**
leporina = **D. leporina**
thouini = **D. thouini**
lesueuri = **D. nana carnescens**
leucantha = **D. versicolor argyrostachya**
leucosericea = **D. leucosericea**
leucostachya = **D. leucostachya**
leucostoma = **D. lutea lutea**
lloydii = **D. capitata capitata**
longeracemosa = **D. bicolor bicolor**
longifolia = **D. polystachya**
longipila = **D. neo-mexicana longipila**
lucida = **D. urceolata lucida**
luisana = **D. luisana**
lumholtzii = **D. lumholtzii**
lutea = **D. lutea**
caudata = **D. lutea lutea**
macrostachya = **D. coerulea longispicata**
maritima = **Marina maritima**
megalostachya = **Dalea bicolor orcuttiana**
melantha = **D. melantha**
microphylla = **D. carthagenensis brevis**
brevis = praec.
minor = **Marina minor**
minutiflora = **M. minutiflora**
minutifolia = **Dalea minutifolia**
mollis = **D. mollis**
neo-mexicana = **D. neo-mexicana neo-mexicana**
mollissima = **D. mollissima**
mucronata = **D. mucronata**
mutabilis = **D. obovatifolia obovatifolia**
myriadenia = **D. myriadenia**
nana = **D. nana**
naviculifolia = **D. bicolor naviculifolia**
neglecta (Parish) = **Psorothamnus arborescens arborescens**
neglecta (Rose) = **Marina neglecta neglecta**
neo-mexicana = **Dalea neo-mexicana**
nigra = **D. cliffortiana**
nova = **D. cylindrica nova**
nutans = **Marina nutans**
oaxacana = **Dalea virgata**
oblongifolia = **D. pazensis**
occidentalis = **D. scandens occidentalis**
oculata = **Marina oculata**
onobrychioides = **Dalea elegans onobrychioides**

PAROSELA (*Cont.*)

onobrychis = **D. onobrychis**
orcuttii = **Marina orcuttii**
ordiae = **Dalea albiflora**
painteri = **D. lutea lutea**
palmeri = **Marina palmeri**
parryi = **M. parryi**
parvifolia = **D. tenuicaulis**
pauciflora = **D. elata**
paysoniae = **D. bicolor argyrea**
pazensis = **D. pazensis**
pectinata = **D. pectinata**
peninsularis = **Marina peninsularis**
pennellii = **Dalea pennellii**
peruviana = **D. exilis**
pilifera = **D. reclinata**
pilosa = **D. mollis**
pilosissima = **D. cyanea cyanea**
platyphylla = **D. scandens occidentalis**
plumosa = **D. lutea lutea**
pogonathera = **D. pogonathera**
polycephala = **D. minutifolia**
minutifolia = praec.
polydenia = **Psorothamnus polydenius**
subnuda = **Ps. polydenius polydenius**
polygonoides = **Dalea polygonoides**
polyphylla = **D. foliolosa foliolosa**
porteri = **D. jamesii**
pringlei = **D. pringlei**
procumbens = **Marina procumbens**
psoraleoides = **Dalea tomentosa psoraleoides**
puberula = **Psorothamnus schottii**
pueblensis = **Marina pueblensis**
pulchella = **Dalea dorycnioides**
pumila = **D. cliffortiana**
purpusi = **D. purpusi**
quinqueflora = **D. capitata quinqueflora**
radicans = **D. radicans**
ramosissima = **D. brandegei**
reclinata = **D. reclinata**
revoluta = **D. revoluta**
roseiflora = **D. polystachya**
roseola = **D. foliolosa foliolosa**
rubescens = **D. nana carnescens**
rubricaulis (Macbr.) = **D. kuntzei**
rubricaulis (Rusby) = **D. cylindrica cylindrica**
saffordii = **D. saffordii**
sanctae-crucis = **D. versicolor sessilis**
saundersii = **Psorothamnus arborescens arborescens**
sawadae = **D. cylindrica nova**
scandens = **D. scandens**
scariosa = **D. scariosa**
schaffneri = **D. hegewischiana**
schotti = **Psorothamnus schottii**
puberula = praec.

PAROSELA (*Cont.*)
scoparia = **Ps. scoparius**
arsenei = praec.
seemanni = **Dalea bicolor bicolor**
sericea = **D. sericea**
sericocalyx = **D. sericocalyx**
sericophylla = **D. weberbaueri sericophylla**
sessilis = **D. versicolor sessilis**
similis = **D. similis**
smithii (Macbr.) = **D. smithii**
smithii (Rydb.) = **D. virgata**
spiciformis = **Marina spiciformis**
spinosa = **Psorothamnus spinosus**
submontana = **Marina nutans**
subvillosa = **Dalea lanata terminalis**
sulfurea = **D. cylindrica sulfurea**
tehuacana = **D. carthagenensis capitulata**
tenuicaulis = **D. tenuicaulis**
terminalis = **D. lanata terminalis**
thompsonae = **Psorothamnus thompsonae**
thouini = **Dalea thouini**
thyrsiflora = **D. scandens paucifolia**
tinctoria = **Psorothamnus emoryi arenarius**
tomentosa = **Dalea tomentosa tomentosa**
psoraleoides = **D. tomentosa psoraleoides**
townsendii = **D. reclinata**
trichocalyx = **D. carthagenensis trichocalyx**
trifoliolata = **D. prostrata**
triphylla = **D. prostrata**
trochilina = **D. trochilina**
tsugoides = **D. versicolor versicolor**
tuberculata = **D. bicolor bicolor**
tuberculina = **D. bicolor bicolor**
uncifera = **D. obovatifolia uncifera**
unifoliata = **Marina unifoliolata**
unifoliolata = praec.
urceolata = **Dalea urceolata**
variegata = **Marina divaricata**
vernicia = **D. foliolosa citrina**
citrina = praec.
versicolor = **D. versicolor**
tsugoides = praec.
vetula = **Marina vetula**
vicina = **D. carthagenensis brevis**
viridiflora = **D. viridiflora**
vulneraria = **D. scandens vulneraria**
walkerae = **D. pogonathera walkerae**
wardii = **D. lutea lutea**
warnockii = **D. wrightii**
watsoni = **D. albiflora**
weberbaueri = **D. weberbaueri**
wheeleri = **Psorothamnus arborescens minutifolius**
whitehouseae = **Dalea nana carnescens**
wislizeni = **D. versicolor glabrescens**
sanctae-crucis = **D. versicolor sessilis**

PAROSELA (*Cont.*)
sessilis = praec.
wrightii = **D. wrightii**
zimapanica = **D. zimapanica**
PETALOSTEMON = DALEA sect. KUHNISTERA
subgen. *KUHNISTERA* = DALEA ser. KUHNISTERA
subgen. *PETALOSTEMON* = DALEA ser. CANDIDAE
ser. *CANDIDI* = DALEA ser. CANDIDAE
ser. *CARNEI* = DALEA ser. CANDIDAE
ser. *COMPACTI* = DALEA ser. COMPACTAE
ser. *EXILES* = DALEA ser. DALEA
ser. *FOLIOSI* = DALEA ser. CANDIDAE
ser. *ORNATI* = DALEA ser. COMPACTAE
ser. *PHLEOIDES* = DALEA ser. CANDIDAE
ser. *PILULOSI* = DALEA ser. THORNBERA
ser. *PROSTRATI* = DALEA ser. CANDIDAE
ser. *PURPUREI* = DALEA ser. PURPUREAE
ser. *SCARIOSI* = DALEA ser. CANDIDAE
ser. *VILLOSI* = DALEA ser. PURPUREAE
adenopodum = **Dalea pinnata adenopoda**
alopecuroides = **D. leporina**
albidum = **D. carnea albida**
amethystinum — Appendix I, p. 585
arenicola = **D. purpurea arenicola**
bicolor = **D. carnea gracilis**
candidum = **D. candida candida**
oligophyllum = **D. candida oligophylla**
capitatum = **D. aurea**
carneum = **D. carnea carnea**
albidum = **D. carnea albida**
caroliniense = **D. pinnata pinnata**
chiapense = **D. tomentosa psoraleoides**
compactum = **D. compacta compacta**
confusum = **D. confusa confusa**
corymbosum = **D. pinnata pinnata**
adenopodum = **D. pinnata adenopoda**
trifoliatum = **D. pinnata trifoliata**
decumbens = **D. compacta compacta**
emarginatum = **D. emarginata**
evanescens = **Marina evanescens**
exile = **Dalea exigua**
feayi = **D. feayi**
flavescens = **D. flavescens**
foliosum = **D. foliosa**
gattingeri = **D. gattingeri**
glandulosum = **D. phleoides phleoides**
gracile = **D. carnea gracilis**
oligophyllum = **D. candida oligophylla**
griseum = **D. villosa grisea**
grothii = **D. tenuis**

PETALOSTEMON (*Cont.*)
lagopus = **D. ornata**
laxiflorum = **D. enneandra**
macrostachyum = **D. cylindriceps**
microphyllum = **D. phleoides microphylla**
molle = **D. purpurea purpurea**
multiflorum = **D. multiflora**
obovatum = **D. obovata**
obreniforme = **D. obreniformis**
occidentale = **D. candida oligophylla**
oligophyllum = **D. candida oligophylla**
oreophilum = **D. leporina**
ornatum = **D. ornata**
pallidum = **D. ornata**
phleoides = **D. phleoides phleoides**
microphyllum = **D. phleoides microphylla**
pilulosum = **D. albiflora**
pinnatum = **D. pinnata**
pinnatum = **D. pinnata pinnata**
trifoliatum = **D. pinnata trifoliata**
porterianum = **D. tenuifolia**
prostratum = **D. scariosa**
pubescens (A. Hell.) = **D. compacta pubescens**
pubescens (A. Nels.) = **D. purpurea purpurea**
pulcherrimum = **D. compacta pubescens**
purpureum = **D. purpurea purpurea**
albiflorum = **D. purpurea purpurea**
arenarium = **D. purpurea purpurea**
molle = **D. purpurea purpurea**
pubescens (Boivin) = **D. compacta pubescens**
pubescens (Fassett) = **D. compacta pubescens**
pubescens (Harrington) = **D. purpurea purpurea**
reclinatum = **D. reclinata**
reverchoni = **D. reverchoni**
roseum = **D. carnea carnea**
rothrockii = **D. tenuifolia**
sabinale = **D. sabinalis**
scariosum = **D. scariosa**
searlsiae = **D. searlsiae**
sonorae = **D. candida oligophylla**
standleyanum = **D. purpurea purpurea**
stanfieldii = **D. tenuis**
tenuifolium = **D. tenuifolia**
tenue = **D. tenuis**
tripetalum = **D. urceolata tripetala**
truncatum = **D. candida oligophylla**
villosum = **D. villosa villosa**
violaceum = **D. purpurea purpurea**
pubescens = **D. compacta pubescens**
tenue = **D. tenuis**
virgatum (Nees) — Appendix I, p. 586

PETALOSTEMON (*Cont.*)
virgatum (Scheele) = **D. compacta pubescens**
PETALOSTEMUM = PETALOSTEMON
PSORALEA
alopecuroides = **Dalea leporina**
annua = **D. cliffortiana**
arborea — Appendix III, p. 587
aurea = **Dalea aurea**
azurea = **D. azurea**
candida = **D. candida**
carnea = **D. carnea**
carthagenensis = **D. carthagenensis**
citriodora = **D. foliolosa**
citrodora = praec.
corymbosa = **D. pinnata pinnata**
dalea = **D. cliffortiana**
emphysodes = **D. carthagenensis carthagenensis**
enneaphylla = praec.
foliolosa = **D. foliolosa**
fruticosa — Appendix III, p. 588
humilis = **Dalea scandens paucifolia**
jamesii = **D. jamesii**
laevigata — Appendix I, p. 586
lagopus = **Dalea leporina**
laxiflora = **D. enneandra**
leporina = **D. leporina**
lutea = **D. lutea**
luteola = **D. zimapanica**
multifoliolata = **Errazurizia multifoliolata**
mutabilis = **Dalea obovatifolia obovatifolia**
nutans = **Marina nutans**
pedunculata = **Dalea pedunculata**
phymatodes = **D. carthagenensis carthagenensis**
polystachya = **D. polystachya**
procumbens = **Marina procumbens**
purpurea (Poir.) = **Dalea purpurea purpurea**
purpurea (S. & M.) — Appendix I, p. 586
reclinata = **Dalea reclinata**
scandens = **D. scandens scandens**
sericea — Appendix I, p. 586
stipularis — Appendix III, p. 588
tomentosa = **Dalea tomentosa tomentosa**
PSOROBATUS = ERRAZURIZIA sect. PSOROBATUS
benthami = **Errazurizia benthami**
megacarpus = **E. megacarpa**
PSORODENDRON = PSOROTHAMNUS sect. XYLODALEA
amoenum = **Psorothamnus arborescens pubescens**
arborescens = **Psorothamnus arborescens arborescens**
californicum = **Psorothamnus arborescens simplifolius**

PSORODENDRON (*Cont.*)
fremontii = **Psorothamnus fremontii**
johnsoni = **Psorothamnus fremontii**
kingii = **Psorothamnus kingii**
puberulum = **Psorothamnus schottii**
pubescens = **Psorothamnus arborescens pubescens**
saundersii = **Psorothamnus arborescens arborescens**
schottii = **Psorothamnus schottii**
spinosum = **Psorothamnus spinosus**
wheeleri = **Psorothamnus arborescens minutifolius**
PSOROTHAMNUS — p. 21
sect. CAPNODENDRON — p. 23
sect. PSOROTHAMNUS — p. 41
sect. WINNEMUCCA — p. 26
sect. XYLODALEA — p. 27
arborescens — p. 31
arborescens — p. 33, pl. IV
minutifolius — p. 34, pl. IV
pubescens — p. 37, pl. IV
simplifolius — p. 36, pl. IV
arenarius = **emoryi arenarius**
dentatus = **emoryi arenarius**
emoryi — p. 43
arenarius — p. 46, pl. V
emoryi — p. 45, pl. VI
fremontii — p. 38
attenuatus — p. 41, pl. IV
fremontii — p. 40, pl. IV
junceus = **Ps. emoryi emoryi**
kingii — p. 26, pl. III
PSOROTHAMNUS (*Cont.*)
polydenius — p. 49
jonesii — p. 51, pl. VII
polydenius — p. 50, pl. VI
schottii — p. 29, pl. IV
scoparius — p. 47, pl. V
spinosus — p. 24, pl. III
subnudus = **Ps. polydenius polydenius**
thompsonae — p. 52
thompsonae — p. 53, pl. VII
whitingi — p. 54, pl. VII
tinctorius = **Ps. emoryi arenarius**

TEPHROSIA
coerulea = **Dalea coerulea coerulea**
THORNBERA = DALEA sect. THORNBERA
albiflora = **Dalea albiflora**
villosa = praec.
dalea = **D. cliffortiana**
grayi = **D. grayi**
leucantha = **D. albiflora**
lutea = **D. rubrolutea**
nelsonii = **D. nelsonii**
ordiae = **D. albiflora**
pringlei = **D. pringlei**
pumila = **D. cliffortiana**
revoluta = **D. revoluta**
robusta = **D. cliffortiana**
villosa = **D. albiflora**
watsoni = **D. albiflora**
TRICHOPODIUM = MARINA sect. CARROA
diffusum = **Marina diffusa diffusa**
glandulosum = praec.